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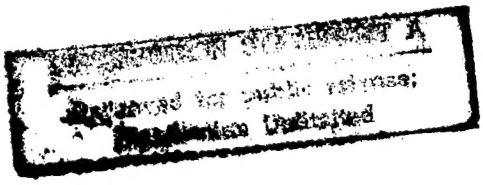
China Report

SCIENCE AND TECHNOLOGY



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NATIONAL DEVELOPMENTS

FUTURE CHINESE ACADEMY OF SCIENCES WORK PROJECTED

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 2, Apr 84 pp 1-8

[Article by Lu Jiaxi [4151 0857 6932] of the Chinese Academy of Sciences (CAS): "Tentative Plan for the Work of the CAS in Coming Years"; Editor's note: This article is the second part of the work report given by academy president, Lu Jiaxi, on 5 January 1984 at the Fifth General CAS Academic Department Committee. The subject of the first part was "The condition of the work since the Fourth General Academic Department Committee," and could not be printed here due to space limitations.]

[Text] Our country's scientific and technical work is now facing new circumstances and scientific and technical progress is increasingly becoming a powerful force in our economic and social development. The need for economic development to rely on science and technology and for science and technology to serve economic construction is not only a guiding principle in our country's economic construction and scientific and technical work, but is also a fundamental principle in our modernization. The party Central Committee Secretariat has clearly pointed out recently that the policies and duties of the CAS should be to vigorously strengthen applied research, to both actively and freely participate in development work, and to continue to pay great attention to basic research. In future work, the Academy of Sciences should continue to conscientiously carry out the party Central Committee's guiding principles on scientific and technical work and its directives on CAS policies and duties, do a better job of organizing the masses of scientists and technicians throughout the academy to actively join in practicing socialist modernization, and make its own contribution to the development of our country's national economy and to the improvement of scientific and technical standards.

In order to better develop the role of the CAS, we must first look at the new situation and needs facing it under the new circumstances. The major ones are as follows. First, the efforts of the CAS are urgently needed to achieve the magnificent goal proposed by the party Central Committee of quadrupling the gross annual output value of industry and agriculture within 20 years or by the end of the century. Second, the problem of the "new world industrial revolution" is now being widely discussed throughout the world, this necessarily involves a series of problems such as the transformation of traditional industry, the development of new industry and breakthroughs in new technology, and the development of the role of the CAS is urgently needed to meet this new challenge.

Third, our country's science and technology has been established and has developed significantly since the 1950's; industrial departments, colleges and universities, national defense departments and localities all have their own ranks of scientists and technicians, and there is an urgent need under these new circumstances for the CAS to develop its advantages and characteristics and to strive to improve scientific research work standards. Fourth, due to the carrying out of an open door policy, there is an urgent need for the CAS to achieve further developments in foreign competition.

In summary, we must soberly analyze the new situation and needs facing the CAS, calmly estimate our advantages, specialties and weaknesses, do a good job of selecting the work which we should and are able to do, and strive to make new and greater contributions to the country during the new historical period of socialist modernization.

We will call a working conference to arrange how the specific work of the CAS should be done. Based on over 2 years of work experience, we here only propose certain tentative plans and views for the work of the CAS in coming years.

First, We Must Conscientiously Carry Out the Directives of the Central Committee Secretariat on CAS Policies and Duties

Vigorously strengthening applied research will be the key problem for the CAS in the coming period. Our country's production technology standards improve slowly, there are a series of long-unsolved scientific and technical problems in the national economy's major construction projects, the major technological transformation of traditional industry and the establishment and development of new industry; and the major reason why our product quality has not been able to reach advanced norms, quality has not been stable enough and development work has long been duplicated with low standards, is that applied research has been too weak and has not received the proper attention and support.

Judging from the needs of national economic construction for the CAS, we should stress the carrying out of systematic applied research on selected major and key problems in economic construction, clarify certain laws of production technology, and not only know how but also why, in order to strengthen scientific guidance of production technology and the use of initiative in blazing new trails and developing ability. For instance, we must do thorough, systematic research on all problems such as how to solve certain key scientific and technical problems in national key construction projects; how to strengthen information, life and materials sciences and to apply these technologies in national economic construction; how to greatly reduce energy consumption in all departments of the national economy; how to transform and blaze new trails in digesting and absorbing imported technology (in fact, the process is "first use, second criticize, third transform, and fourth create"); and how to rationally develop and utilize our country's energy and natural resources. In judging CAS applied research in these years by these kinds of needs, we must say that it indeed looks very weak and must be vigorously strengthened.

Development work directly affects development of production and is thus very important. Due to historical reasons, a considerable group of CAS scientists and technicians have long been engaged in development work, they are strong in this area, and the roles of these comrades should continue to be developed. Moreover, intermediate links between scientific research and production are at

present not very clear and the CAS must actively engage in certain development work. In another area, industrial departments have now organized and built considerable R&D forces and the CAS should pay attention to developing its advantages and specialties in the area of development work. We must strive to develop the results of basic and applied research into new technologies, methods, materials, products and equipment and help all departments of the national economy to accelerate their technological transformation; we must use scientific research results acquired in the service of national defense and scientific research per se, including certain sophisticated technology and special-purpose products, in national economic construction; we must actively do good work in digesting and absorbing imported appropriate technology; and we must also actively assist related departments in carrying out intermediate experimental work, and suitably establish a few intermediate experimental bases in order to accelerate the popularization and application of scientific research results. In summary, the CAS should engage in more development work which is needed by the country, which is in its own specialties, which production departments temporarily cannot attend to, and most important which solves key scientific and technical problems in production and construction. Design research organs of industrial departments should still of course be mainly relied on to carry out most development work. The CAS must be well coordinated with related departments, as much as possible avoid duplicate research on the same level with them, and avoid turning its subordinate research institutes into product research institutes. The CAS must be actively responsible for development work entrusted to industrial and national defense departments.

Since basic research is of major significance in improving our country's scientific and technical standards (including applied research and development work standards) and in developing and training qualified scientists and technicians, the CAS must continue to pay great attention to it and give it both adequate and steady support. We must first stress supporting those basic research problems which can have a major effect on long-range development of science and technology or the national economy; second, we must strive to rank among the world's most advanced by the end of the century in certain scientific fields in which we are fairly strong and have fairly good conditions; and third, we must pay attention to using new ideas in research methods and measures brought forth in basic research or their derived results to serve economic construction.

The guiding principles of our country's scientific and technical work are now clear, and the party Central Committee and the State Council have also issued clear directives concerning the problem of CAS policies and duties. We should further unify our thoughts and actions based on this.

Second, the CAS Should Contribute to Realizing the General Strategic Goal of Quadrupling the Gross Annual Industrial and Agricultural Output Value by the End of the Century, and Also to Long-Range Development of Our Country's Science, Technology and Economic Construction

Comrade Ziyang has pointed out recently that the CAS should make a major contribution to quadrupling our country's gross industrial and agricultural output value by the end of the century. The major problems which need to be

solved now are whether scientists and technicians can truly develop their roles and whether the CAS can make its own contribution in the process of realizing this magnificent goal of the four modernizations in our country in the next 20 years. We must mainly judge the work of the CAS in the next 10 to 20 years by the standard of the size of its accomplishments in this area. We must have a sense of responsibility and a sense of urgency. We are once again facing a moment of choice as to whether we will finally forge ahead and be determined to undertake and complete this glorious but difficult scientific research duty, or whether faced with this difficult task, we will hold back and fail to live up to the party and nation's ardent expectations for us. Our choice can only be to forge ahead.

Judging from the course of social and economic development in the past several decades in certain advanced countries and areas as well as in developing countries, we must pay attention to the development trend which has appeared in economics from the labor-intensive form to the knowledge-intensive form and even to the science and technology-intensive form, and moreover to the new trend which has appeared in the transition from industrial to information societies. Understanding the circumstances of the new needs of national economic construction and the "new industrial revolution" which is appearing throughout the world as well as its major scientific and technical breakthroughs, correctly choosing development priorities for advanced scientific and technical fields, accurately setting scientific and technical development strategy and doing a good job of developing the capacity to react quickly, can better spur and accelerate social and economic development, enable the foremost needs of advanced scientific and national (regional) development to be synchronized, and can also create a situation in which it is quite possible that development breakthroughs will occur. The present organization of our forces, beginning with distinguishing the eight areas of agriculture, natural resources and environment, energy resources, materials science, information science, technical science (engineering science), life science and physical science to formulate our plans, strategies and tentative plans, is based on this understanding.

1. Realizing the Strategic Goal of "Quadrupling" Is an Important Matter Related to the Success or Failure of Modernization. In order to realize "quadrupling," we must center on the general goal of the next 15 years of scientific and technical progress, choose a group of projects which have significant economic or social benefits for the national economy, organize them, jointly tackle their major, key and comprehensive scientific and technical problems, do a good job of the essential early-stage scientific and technical work for certain major engineering and construction projects, and provide the country with a scientific basis and advisory views to make policy decisions; we must strengthen technical science (engineering science) research, solve mechanical and fundamental scientific and technical problems affecting production development, and push development of production to higher levels; based on the needs of national construction and our own specialties, we must freely provide all departments of the national economy with a fairly high standard of new techniques, materials, products and technology; we must vigorously strengthen the popularization and application of scientific research results, strive to use the most recent scientific and technical accomplishments such as information technology, new materials, new measuring and testing methods, and remote sensing, laser and

nuclear technologies, and support all departments of the national economy, enabling it to gradually be transformed into a new technical base; and we must also actively help industrial departments and production enterprises to digest, absorb and transform imported technology, and strive to spur production technology standards to leap toward higher levels.

2. We Must Organize Our Forces and Strengthen Scientific and Technical Work in Fields and Areas of Major Strategic Significance for Our Country's Economic Development. For instance, the problem of energy sources is the key problem in our country's four modernizations and the CAS should actively develop scientific research in all areas such as exploring and developing energy sources, opening up new energy sources, saving energy and improving energy utilization efficiency, and must pay particular attention to comprehensive and systematic research of diversified energy sources with coal as the major factor. In the area of natural resources, we must both carry out systematic analysis based on available data and further thorough systematic research on this basis, also give precedence to stressing strongly comprehensive development work related to the overall situation on major problems, and gradually establish an environmental and natural resource information system for service both within and outside of the academy. In the area of agriculture, we must strengthen strategic research on agricultural development. From the point of view of science and technology, faced with analyzing all links of the whole process of the production, processing, and even the utilization and consumption of agricultural products, we must seek ways to improve the comprehensive results of the whole system, pay attention to applying new scientific and technical accomplishments, and explore the opening up of new agricultural channels. In addition, we must also actively carry out scientific research work in the areas of using water resources, developing agriculture in dry and semi-dry areas, improving low-yield areas and developing the seas and oceans. In the area of regional development, we must give priority to developing areas where natural resources are seriously destroyed and are in urgent need of being harnessed and to research in national key development areas, such as in bringing the loess plateau and the Yellow and Huai Seas areas under control and developing the great Northwest.

3. We Must Conscientiously Stress Problems of the "New World Industrial Revolution." This is in fact a large number of recent scientific and technological accomplishments such as micro-electronic technology, computers, communications technology, lasers, biological engineering, robots and new materials with information science as its nucleus, and is a new stage in the widespread application of the development of the productive forces in all fields of mankind's economic activity and social life. The party Central Committee and the State Council have paid special attention to this. Comrade Ziyang referred to it not long ago as both an opportunity and a challenge for us. If we use the opportunity well, stress the application of new scientific and technical results and develop our own economy, it will enable us to reduce the economic and technical disparities between us and advanced countries. If we don't handle it properly or look on it with unconcern, it will cause the disparities between us and advanced countries and advanced world levels to expand, and will possibly leave us even further behind. Comrade Ziyang has also said

that in order to grasp this opportunity, our country's economic construction and scientific and technical enterprises should be rooted in the present and we should strive to master all present work, and moreover we should take a broad and long-term view, look ahead to new trends in world economic, scientific and technical development, and consider which of them we should make use of and pay attention to, thus enabling our socialist modernization to be somewhat better carried out.

Based on the spirit of Comrade Ziyang's instructions, the CAS should actively use its initiative to meet this challenge, vigorously organize research in new fields, and open up new ways to develop a group of new industries. It should be stated that the CAS had made contributions in the past to developing our country's new industries and new technical fields in areas such as semiconductors, computers, large-scale integrated circuits, lasers and new types of materials, and has built up a definite academic foundation and raised up a group of qualified scientists and technicians with fairly high standards. The CAS is at present still carrying out thorough research in these areas as well as in fields such as information, life and materials sciences. We should emphasize mastering work in these areas, carry out these matters in a down-to-earth manner, and give the development priority to enabling them to be closely related to national economic construction and to have important application prospects, resulting in the initiation of new industrial disciplines. We must strengthen interdisciplinary research in computer science and artificial intelligence, strive to rather quickly establish large-scale and extra large-scale integrated circuit computer auxiliary design systems, strengthen research and technical development of software theory, establish high level software engineering service systems, develop high performance structural materials and high technology materials, and support development of biological engineering industrialization. Based on our available strengths, we have decided to organize in succession a group of new R&D centers including computer and integrated circuit, software, biological engineering and new type materials R&D centers as well as laser and optical instrument and remote sensing technology research service centers, the goal being the need to strive to contribute to popularizing and applying the latest accomplishments of these sciences and technologies. The CAS must moreover also carry out thorough research in new technical fields, recommend and encourage staff members and workers throughout the academy to be concerned about, to understand and to master the new achievements created by contemporary mankind, regularly understand and follow the latest world technical trends, and integrate and test them in changing China's status quo in order to seek for and use the opportunity to accelerate our progress in modernization.

4. Through Basic Research and the Continuous Use of New Knowledge, New Concepts and Qualified Personnel With Creative Ability, We Must Provide the Guiding and Reserve Forces for the Overall Development of Science, Technology and Production. We should foresee certain new things, form our own characteristics in the areas of economic, scientific and technical development, and travel our own road. We should particularly determine to continue to master advanced scientific and technical developments and academic disciplines in which we have a solid foundation. In summary, we must accumulate, store, blaze new trails and improve in the area of science and technology, and continuously discover, create, develop and accomplish.

Third, We Must Fully Develop the Role of Academic Department Committee Members

Concerning the nature and duties of the general academic department committee, based on the stipulations of the "CAS Trial Solution" adopted by the Fourth General Academic Department Committee, the general academic department committee is the highest policy-making body of the CAS, and the CAS presidium is the policy-making body when the general academic department committee is not in session. But many academic department committee members who are responsible for academic department Standing Committee work have repeatedly pointed out their sincere desire to reduce their responsibility for CAS administrative work, to better develop their academic specialties and to provide more advice and views on national scientific and technical policy. Moreover, it has also been discovered in practical work that most academic department committee and presidium members come from outside of the academy, all problems in making policy for CAS professional management work, and particularly ones such as appointing and removing cadres and distributing funds, must be submitted to a presidium conference for discussion and decision, and this is indeed a hardship. Thus the fact-finding group organized by the State Council's leading science and technology small group office and the CAS leading party group have jointly proposed that the CAS general academic department committee and presidium should clearly not be the CAS policy-making body, and that the academic department committee member should still be the country's highest honored title in the area of science and technology. The general academic department committee's major duties are to carry out academic appraisals and to give advice. The function of the CAS presidium is, through the general academic department committee and other forms, to organize the academic department committee members to discuss and study national scientific and technical development and scientific and technical problems in modernization, to actively participate in formulating policy and advising on these problems, and to hold discussions and give guidance on major CAS academic problems. The CAS has carried out the system of job responsibility for the academy president, the choice of academy president is through nomination by the Premier of the State Council, and appointment is requested from the National People's Congress or its Standing Committee. The Central Committee Secretariat has agreed with this proposal and has emphatically pointed out that it is essential to enable the academic department committee members to free themselves as much as possible from the interference of administrative work, to fully develop their academic specialties, to be concerned with and to study major problems of national construction, and to actively participate in policy-making activity in the area of science and technology and in economic and social development.

Based on the above spirit, we understand that the major duties of the academic department committee members: 1) to provide advice on policy decisions for major national problems; and 2) to hold discussions and give guidance on major CAS academic problems.

As to participating in policy decisions on major national problems, we must realize that along with the comprehensive development of socialist modernization, all solutions of major social and economic problems must be guided by scientific knowledge and rely on scientific and technical data, and must utilize the achievements, measures and methods of science and technology. But all scientific and technical developments require definite social and economic conditions and they all affect society and the economy.

Since the Third Plenary Session of the Eleventh Central Committee, all academic department committee members have in different ways done much work in this area. A group of CAS research organs and personnel have also directly and indirectly participated in work in these areas. But generally speaking, work in this area at present still appears very weak.

The CAS should hereafter rely on the masses of academic department committee members and all scientists and technicians, and strive to strengthen strategic research on major social and economic problems in such areas as agriculture, energy sources, natural resources, environment, population and regional development planning. It should strengthen research on major comprehensive scientific and technical problems at home and abroad as well as on development trends of each discipline, on the relationship between science and technology and social and economic development, and on the social and economic results of scientific and technical progress as well as on certain theoretical and practical problems such as technical transformation, the training and utilization of qualified personnel, and scientific and technical history.

In order to do good work in this area, in addition to the need for the academy's departments to strengthen policy analysis work and for related research institutes to pay attention to organizing and training comprehensive analysis personnel, we hope we can further develop the academic department committee members' academic specialties, and based on the practical needs of all areas of national construction, organize various special committees, strive to study certain major strategic problems, and actively provide advice and opinions for the country and related departments. This should be regarded as a major task to be emphasized in future CAS work. All academic department committee members have also actively participated in these years in such work as examining key CAS projects and appraising research institutes, and have greatly helped and guided the CAS. We hope that in the future, while participating in advisory work on major national problems, all academic department committee members will continue to be concerned with and guide the work of the CAS and all its subordinate research institutes. We believe that there are at least four areas of work which from now on must rely on the academic department committee members to be carried out. First, we must utilize their extensive knowledge and their views on participating in the policy-making process on key national problems for future scientific and technical development directions, and guide the work of the CAS centered on major scientific and technical problems in economic construction and on development of advanced scientific and technical fields, enabling the CAS to be able to better develop the role of comprehensive natural science research centers throughout the country. Second, we must continue to participate in discussions with research institutes, in consideration of long-range CAS planning and in examination of major CAS projects. Third, we must connect the CAS with industrial departments, production enterprises and colleges and universities through all academic department committee members, build bridges between scientific research and production, and strengthen scientific and technical cooperation between the five front armies. Fourth, we must rely on academic department committee members to actively develop and enliven academic exchange activity at home and abroad.

The CAS and all its subordinate research institutes should still maintain close relations with academic department committee members from outside of the academy. The academic department committee members have a fairly thorough understanding of research institutes which have been appraised, and these institutes should continue to advance their major scientific research work through regular academic department reports to the academic department committee members. We also hope that the academic department committee members will continue to give concern, guidance, help and criticism to the academic departments. Those research institutes which have still not been appraised should do a better job of pre-appraisal preparation work, enabling academic department committee members to better understand their scientific research work. Units responsible for important problems should also adopt a similar attitude.

After the nature and duties of the academic department committee members, the general academic department committee and its presidium have been somewhat altered, certain new situations and problems will definitely arise. It is thus essential that the "CAS Trial Constitution" be quite thoroughly revised. In order to act with caution, to hear all possible views and to conscientiously investigate and study, based on decisions by the party Central Committee and after this general committee, we will be responsible for organizing special classes at this CAS conference on academy duties, and for proposing tentative ideas on revision. In order to facilitate the work of all academic departments, we now propose that the presidium establish an academic secretarial office to carry out regular organizing work in the area of advice and appraisal. Standing Committees of all academic departments from now on should not discuss specific organization and management problems in the work of each institute subordinate to the CAS, but under the leadership of the director of the academic department, it will be the responsibility of the full-time academic department deputy director of academy work to make regular brief reports to the Standing Committee. Other academic department Standing Committee academic duties will be temporarily unchanged.

At a tea party on 1 November 1979 on the 30th anniversary of the founding of the CAS, Comrade Yaobang said that "The party Central Committee and the State Council are the headquarters leading us all to scale the heights in science, and the National Science Committee and the CAS are this battlefront's staff officers." We believe that provided we work together, we can definitely justify the great trust of the party Central Committee and the State Council and do a better job of developing the role of the staff officers.

Fourth, We Must Actively and Reliably Continue to Reform Scientific Research Management

Comrade Ziyang pointed out recently that reform of the scientific and technical system is mainly centered on two problems. The first is the need to favor overcoming the separation between scientific research and production, and the second is the need to favor fully developing the role of qualified personnel. Comrade Ziyang also said that there has been too much waste of manpower and material resources, duplicate labor and cancelling out of forces in China's scientific and technical system, and that although there were originally few qualified personnel, yet there has also been a large waste of manpower. Will it be enough to merely

patch it up or must it undergo major reform? If it isn't reformed for 5 years, it will have to be reformed 5 years later, and if it isn't reformed for a decade, then it will have to be reformed in 2 decades. That is because this system hampers development of the productive forces. We must be careful and investigate the situation, but must first establish the necessary reform ideology. We can take simple steps first and difficult ones later.

Based on the spirit of Comrade Ziyang's instructions and on our practice of reform experiments in all units in these years and particularly in the last year, we believe that the CAS should hereafter further explore reform in the following areas.

1. Vigorously Strengthen Contact and Cooperation With Colleges and Universities, Industrial Departments and Localities. This will help us to more thoroughly understand the practical needs of economic construction, counteract our weaknesses, enable our choice of scientific research subjects to be more directed, and moreover can also enable our scientific research achievements to be more successfully popularized and applied. Judged from another aspect, this will also be beneficial in promoting mutual understanding and cooperation between the CAS and economic departments and production enterprises, in linking up both vertical and horizontal channels between scientific research and production, and in accelerating the exchange of knowledge between qualified personnel. This is thus a very important reform in overcoming the separation between scientific research and production.

We must make even greater efforts in the future to enable the CAS to further establish various long-term and stable cooperative relations with fraternal units in colleges and universities, industrial departments and localities, including joint management of research organs, technical development companies, experimental centers and science and technology training classes. We welcome scientists, technicians and graduate students from fraternal units to bring their problems to the CAS and to engage in research or to participate in cooperative research. Whether this research is short-term or fairly long-term, we will as much as possible provide the necessary working conditions. We will also accept scientists and technicians engaged in advanced studies and college students doing fieldwork, and as much as possible train qualified personnel from fraternal units. Moreover, in order to encourage the transfer of knowledge between qualified personnel, we support scientists and technicians being invited to fraternal units to hold part-time jobs, to teach in addition to their main occupations, or to do short-term work until qualified scientists and technicians have been trained. The CAS library information and materials, precision instruments and equipment, and large-scale experimental installations are open to fraternal units. In addition, we welcome scientists and technicians from fraternal units to participate in academic activity conducted by the CAS, are always receptive to talks on commissioned research, transfer of results and product orders, and provide scientific and technical advisory services. We earnestly hope through joint efforts to further set off a new and great cooperative upsurge on our science and technology battlefront.

2. Further Study Reform of Scientific Research Fund Management Systems and Methods, and Continue to Try to Carry Out the Fund and Contract Systems Within the CAS. When distributing scientific research funds in the past, we basically

used the horizontal method. We have begun a set of reforms since 1979 in such methods as budget responsibility, problem business accounting and continuing to use surpluses, and have divided scientific research funds into academy-controlled funds for key problems and general funds cut up and assigned to the institutes. It should be said that these all indicate progress in distribution methods, and have also indeed achieved definite results. But there are still many existing problems. We believe that problem groups are the basic unit of scientific research work, and that funds should be distributed according to problems. Only in this way can we support choosing the best and most important, arouse the enthusiasm of scientific researchers, promote the circulation of qualified personnel, benefit the discovery of outstanding qualified personnel, benefit problem renewal and improve research work standards. Judged by the situation of CAS science fund utilization in the last 2 years, results have been better. A similar fund system method has also in fact been used in academy key problem fund distribution. Through conducting tests at selected points, we can hereafter consider gradually expanding the basic work of the funding system for basic and applied research in order to spur research institutes to pay attention to improving research work and personnel standards. As to development work and some applied research problems, we can gradually adopt methods of signing contracts between problem groups and related academy and institute departments and stipulate fund appropriation according to contract. Problems belonging to key projects are also basically handled now by the method of the academy signing contracts with institutes and offices. We will also encourage research institutes to acquire funds by signing contracts with units outside the academy in order to facilitate the popularization and application of results.

Through gradual practice of the funding and contract systems, we hope to further arouse the sense of responsibility of scientists and technicians, overcome the separation between scientific research and production, accelerate the maturation of qualified personnel, and greatly improve the efficiency and standards of scientific research work.

Reform of scientific research fund management systems and methods requires the academy to devote its major energies to formulating research guides, organizing discussions and investigating the conditions of fund utilization and work progress. Moreover it also requires corresponding changes in research institute management systems and methods.

3. We Must Gradually Change Research Institutes Into "Open" Ones. Personnel cannot now circulate in CAS research units, the average age of scientists and technicians has been rising year by year, and this trend is serious. Problems of personnel aging have become especially prominent in a considerable part of the research units. In order to solve this problem, we must on one hand determine to use all sorts of measures to revise and reorganize existing research organs, including organizational revision of some research institutes; and on the other hand, through conducting tests at selected points, we must consider gradually turning some existing research units into "open" ones. In addition to permanent research personnel, this includes establishing a system of visiting researchers and recruiting research technicians from colleges and universities, industrial departments and production enterprises to come to CAS research units to engage in research work; CAS researchers must also go to colleges and universities and production enterprises to teach in addition to their main occupations, hold

part-time jobs or engage in research work; and we must establish certain large-scale experimental installations and centers, data bases, gene bases, and experimental offices under unusual conditions, which in addition to being for our own use, will also be provided for the use of all related areas throughout the country and become national comprehensive experimental research centers in certain areas.

We believe that gradually turning CAS research units into "open" ones will help in circulating personnel and transferring knowledge, in promoting mutual understanding between the CAS and colleges and universities and production units, in popularizing and applying scientific research results, and also in fully utilizing scientific research conditions and improving the efficiency of scientific research work.

4. We Must Further Develop the Role of Qualified Personnel. (sic) (Translator's note: This heading appears to be a typographical error. I think it should be, "We Must Promote Step by Step CAS Reform") Based on the instructions of Comrade Ziyang and combined with practical conditions in the CAS, we believe that CAS reform should be promoted step by step. The first step is that prior to 1985 it will be of major importance to reform and experiment with management, to try to find out and summarize experience, and to gradually popularize it. The aforementioned scientific research fund distribution method reform is one of the contents of the experiment. The second step is that from 1986 to 1990, based on the requirements of the party Central Committee and the State Council on CAS policy and duties, we must carry out comprehensive revision in the areas of organs and personnel. The entire scope of the CAS must be suitably reduced and standards greatly improved. This will require the energetic support of a group of research units which have international competitive ability and can rank among the world's most advanced; we must take resolute measures to reorganize and revise some research institutes which have had difficulties in forming their characteristics and haven't been able to make significant achievements; and we must also carry out corresponding revision based on this spirit in the area of personnel. The third step is that from 1990 to the end of the century, we must combine reform of the scientific, technical and economic systems throughout the country, and realize the rationalization of CAS organs and systems.

Reform of the scientific research system is many-sided, and reform of many major problems is connected with reform of the economic system. It will be very difficult to separate reform of the economic system and the need to carry out major reforms in the area of the scientific and technical system, but we should have a positive attitude and the necessary reform ideology, conscientiously carry out various experiments, and continue to create experience.

Fifth, Fully Develop the Roles of Qualified Personnel

Comrade Xiaoping has recently said that we must further implement policy on intellectuals and better develop the roles of existing qualified scientists and technicians. He also said that if we want to make good use of foreign experts, we must first be able to make good use of our own. In a recent outline report to the State Council on convening a national science and technology working conference, the National Science Committee proposed six policy limits for

implementing policy on intellectuals. They can be summarized in three areas. The first is the need to encourage and promote free academic discussions. This is particularly important. The prosperity of science relies on the full development of academic democracy, and this has been repeatedly proved by many historical experiences and lessons. The second is the need to create an environment and atmosphere of respect for knowledge and qualified personnel. We have also had many past experiences and lessons in this area which should be conscientiously summarized and remembered, and we should as much as possible avoid repeating historical errors. The third is the need to encourage and support scientists and technicians in striving to study and master the new scientific and technical achievements of the modern world, and to not repeat their spiritual pollution in natural science and technical work. In summary, we must encourage the masses of scientists and technicians to boldly explore and blaze new trails, and enthusiastically support their continued proposal of new ideas, viewpoints, concepts and methods in scientific and technical fields and their exploration of new roads; we must encourage the masses of scientists and technicians to actively participate in advisory activity on major policy decisions, conscientiously listen to their views and proposals, and allow them to contribute their intelligence and wisdom to the magnificent cause of the four modernizations; we must strive to improve their working and living conditions, listen attentively to their voices, be concerned about their sufferings, and allow them to make achievements with single-hearted devotion in scientific research work; and we must use our initiative to be concerned about the progress of scientists and technicians, and as comrades, help them overcome their shortcomings.

We have not at present been able to discover young qualified personnel, or have discovered them but not been able to develop their roles, and this situation must definitely be changed. Comrade Ziyang has said that there are insufficient qualified personnel in some areas in our country, far too many in some units in other areas, and the talents of many are unused. Foreign scientists can often establish their reputations as authorities and make great achievements before they are 30 years old. We here are controlled level by level, have no opportunity to practice, and mostly play small roles. These conditions similarly exist in the CAS. For instance, some young and outstanding scientists and technicians have still not been promoted and have been heavily obstructed. It is thus essential that we carry out reform in all areas such as the cadre system and policy in order to truly create a vital situation wherein the fortifications are stormed so that people of talent come forth in large numbers and the academic atmosphere is enlivened.

We must stress creating the necessary conditions for young and outstanding scientists and technicians, enabling them to mature as quickly as possible and to better develop their roles. The CAS should hereafter continue to strengthen the work of training graduate students, and moreover try out a "post-doctorate" research work system in order to gradually increase the number of personnel in the research ranks who have achieved academic degrees and to enhance the quality of the research ranks.

We should give existing scientists and technicians controlled duties and selected responsibilities, and allow them to have more training and better opportunities in practical professional work. We must moreover encourage and support them in

a fixed scale of responsibility to rely more on actual conditions, to handle all problems independently and on their own initiative, and to creatively improve their work. We should also gradually implement an academic refresher system and strive to create the conditions for them to engage in advanced studies and to improve themselves.

Development of our country's scientific enterprise is now being handled under new circumstances. The duties facing the CAS in coming years will be difficult and the responsibilities heavy. But we believe that provided we firmly rely on all academic department committee members and staff members and workers throughout the academy, go all out, rouse ourselves to catch up, and work hard for the prosperity of the country, then under the leadership of the party Central Committee and the State Council, we will certainly be able to victoriously complete the important task entrusted to us by history.

12267
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HOW TO DO A GOOD JOB OF POPULARIZING SCIENTIFIC AND TECHNICAL KNOWLEDGE

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[Article by Zhang Daoyi [4545 6670 5030], Tao Shilong [7118 0013 7893], and Guo Zhengyi [6753 2973 6146]]

[Text]

I

Natural science and applied technology are man's weapons for knowing and transforming nature. The dissemination and popularization of important scientific notions and technological achievements play a tremendous part in promoting social progress.

In 1543 AD, the immortal work by Nicolaus Copernicus, the astronomer, entitled "On the Revolutions of the Celestial Spheres," was published in Poland. "From that time on, natural science was emancipated from theology" and "began to advance in great strides." ("Complete Works of Marx and Engels," Vol 20, p 363) This promoted the ideological emancipation of mankind. However, "On the Revolutions of the Celestial Spheres" did not receive much attention from the public when it first came out. Even the reactionary Catholic rulers were not yet aware of its dangerous nature. They not only allowed it to be published, but permitted it to be put in the libraries of monasteries so people could read it. It remained obscure for half a century. With the further development of scientific research and the invention and application of the telescope, people like Giordano Bruno and Galileo Galilei enriched, developed, and extensively popularized the theory advanced by Copernicus. It was only then that his heliocentric theory began to be understood by more and more common people and became a spiritual force that shook the religious rule. The church was extremely terrified by and hostile to this development. Thus it resorted to the merciless persecution of scientists who popularized the scientific truth. In 1592, Bruno was arrested and thrown into prison. Eight years later, he was burned to death by the Inquisition at the Campo dei Fiori in Rome. In 1616, the Vatican declared "On the Revolutions of the Celestial Spheres" to be a banned book. In 1633, Galileo was put on trial by the Inquisition because he boldly persisted in blazing new trails in science, opposed reactionary forces and scholasticism, and wrote the book "Dialogue Concerning the Two Chief World Systems, Ptolemaic and Copernican." In order to enable more people to read his book he wrote in Italian instead of in Latin, the language of the scholars at that time. He also adopted the lively form of dialogues in this book.

In 1859 AD, "The Origin of the Species," a great work by Charles Darwin, a biologist, was published in Britain. With the help of an abundance of natural science data, he comprehensively expounded and proved for the first time the materialist theory that living things are constantly developing and evolving, thus smashing the idealist theory that species, which are created by God, will never change. However, the extensive dissemination of Darwin's theory of evolution owed much to the undaunted struggles waged by people like Thomas Huxley, the famous British scientist.

The above facts show that we not only need people to put forward and to test and verify advanced scientific thoughts and theories and scientific and technological achievements, we also need people to actively disseminate and popularize all these, or else they would not be acknowledged by the public. Improvements made in the course of popularization will promote the further development of science and technology.

All reactionary rulers in history were afraid of science. They were even more afraid of the popularization of scientific knowledge. The popularization of scientific knowledge, which is necessary for propelling history forward, has a price tag attached to it. If we do not get rid of feudal and superstitious ideas and benightedness, we have no way of embarking on the road of modernization. Major reforms, whether in production or in politics, are inseparable from the popularization of scientific knowledge.

In the past century, people with lofty ideas who were dedicated to the cause of making China prosperous paid great attention to the work of popularizing scientific knowledge and worked indefatigably in this direction. In 1898, the year the reform movement was carried out, "Tianyan Lun" [1131 3348 6158], a translated work which preached Darwin's theory of evolution, was published. Tan Sitong [6223 0843 0681] and other reformers even gave public lectures to popularize such knowledge of science as the fact that the earth revolves around the sun. Lu Xun pointed out in as early as 1903 that popular science books can help readers "gain some knowledge, smash superstitious ideas they have inherited, reform their thinking, and make up for what is lacking in our culture." Around the time of the May Fourth Movement, people clamored for the need to usher in democracy and science. A great mass fervor for popularizing scientific knowledge emerged. Many scientists wrote popular science articles and gave public lectures. Revolutionary writers like Lu Xun and Mao Dun also contributed a lot in introducing popular science through translations. But in the 30 years that followed, the work of popularizing science encountered numerous difficulties due to imperialist aggression and the reactionary rule of the KMT. Progress was very slow. After the founding of the PRC in 1949, the people's regime made a clean sweep of feudal superstition on a national scale. The cause of popularizing science flourished on an unprecedented scale. Of course things did not always run smoothly. There were bound to be twists and turns. During the decade of internal turmoil, in particular, feudal superstition regained lost grounds because education and popular science activities were trampled underfoot. At present, the popularization of scientific knowledge is still a pressing task in our endeavor to eliminate benightedness and build socialist spiritual civilization.

The popularization of scientific knowledge is not only an important weapon for emancipating the mind and eliminating benightedness, it is also a means for increasing social productivity. Comrade Deng Xiaoping once made this incisive remark on the relationship between science and technology on the one hand and productivity on the other: "The basic factors of productivity are the means of production and labor power. Where do science and technology stand in relation to the means of production and labor power? All means of production in history were associated with particular types of science and technology. Similarly, all labor powers in history were labor powers that had mastered a fair amount of scientific and technical knowledge." ("Selected Works of Deng Xiaoping," p 85) This tells us that science and technology, which are general productive forces in the form of knowledge, must be combined with the basic factors of productivity--the means of production and labor power--before they can be turned into direct productive forces. In other words, they must be grasped by the vast number of laborers through the medium of education and scientific popularization, and must be turned into the intelligence, skills, and experience of the laborers. Exploration and dissemination, as well as improvement and popularization, are two inseparable aspects of scientific and technological development. They complement each other. We should not emphasize one at the expense of another. With science and technology developing as swiftly as they are today, the faster, wider, and deeper advanced and applied science and technology are popularized, the faster will social productivity grow.

In China, the popularization of scientific and technical knowledge is playing an increasingly more obvious role in increasing agricultural production. The popularization of the technique of cultivating hybrid rice has enabled us to increase grain production by more than 30 billion jin in 5 years. The popularization of all kinds of breeding and cultivation techniques has also enabled numerous specialized households in the countryside to become better off through hard work. At the same time, we also realize that many peasants who know nothing about the techniques of applying fertilizer and preventing plant diseases reaped less because they applied too many chemical fertilizers and farm drugs. Experience from the positive and negative aspects prove that the popularization of the most basic knowledge of agricultural science and advanced applied technology is of immense significance to the development of agricultural production in our country. In order to increase labor productivity and achieve better economic results in industry and in other trades and professions, it is also necessary to popularize scientific and technical knowledge and disseminate advanced technology. "Jixie Gongren Sucheng Kantu" [4408 2750 1562 0086 6643 2052 4170 0956] [Easy-To-Learn Diagrams for Mechanics] compiled by Professor Zhao Xuetian [6392 1331 3944] can help the workers master knowledge through diagrams with a view to reducing rejects and improving the quality of products. Professor Hua Luogeng [5478 5012 1649] went down to the grassroots level to disseminate the method of optimization. As a result of his efforts, labor was economized, the consumption of raw and semifinished materials was reduced, and economic results were improved.

A new technological revolution has been brewing in the world in recent years. The dissemination and application of new technology, such as microelectronics,

lasers, new energy resources, new materials, and bioengineering, will lead to new changes in man's economic production and social life. The timely dissemination and popularization of the knowledge of this frontier science and technology is the prerequisite for our efforts to catch up with advanced world levels in science and technology and to achieve the four modernizations. Comrade Zhao Ziyang emphatically pointed out in his "Report on the Sixth 5-Year Plan": "We should put the application and dissemination of the results of scientific research on a par with research itself, commend and reward successes in this field, and overcome the tendency to underrate its importance." The "application and dissemination of the results of scientific research" discussed here is an important component of the work of popularizing scientific and technical knowledge.

II

Our party has always attached importance to the popularization of scientific and technical knowledge. After the 3d Plenary Session of the 11th CPC Central Committee, mass fervor for loving, studying, and using science emerged in the cities and the countryside. The 12th CPC National Congress and the 6th NPC both listed education and science as one of the three major strategic priorities in national economic construction. Article 20 of the new PRC Constitution also made provision for the dissemination of scientific and technical knowledge. All these ensured that the work of popularizing scientific knowledge can develop more swiftly than before. Under this situation, the writing of popular science books also flourished. Today, we have the biggest contingent of popular science writers, the broadest front for popular science writing, and the greatest number of popular science publications in history.

In carrying out the work of popularizing scientific knowledge, we must cater to the needs of economic construction, the needs of the masses, and the needs of the grassroots level, and must wholeheartedly serve the people and socialism. This is the only correct orientation for popularizing scientific knowledge. It is only where its vitality lies. This work should be carried out under the leadership of the party. Activities should be conducted closely around the central task of the four modernizations in order to promote the development of the national economy. This is the theme of the work of popularizing scientific knowledge. At the same time, scientific and technical knowledge relating to livelihood which is of interest to the people should also be popularized. But this should only be put in a secondary position. More efforts should be made to introduce scientific knowledge, such as the knowledge of medical and health care, scientific nursing of infants, and how to use domestic electrical appliances.

In order to cater to the needs of economic construction, we must pay special attention to popularizing applied technology. Idle theorizing will not do. We must make sure that people can receive actual training. At present, some people do not count the dissemination of the knowledge of industrial and agricultural production and relating application techniques as the popularization of scientific knowledge. They think that only the introduction of the knowledge of basic sciences can be considered the popularization of scientific knowledge. We think that both are equally important and should

not be set against each other. As long as what we popularize is science and technology, it makes no difference whether it is the knowledge of basic sciences or the knowledge of applied technology. Both deserve attention and promotion, and neither is to be neglected. The only difference between them is that the emphasis may vary according to the different types of people to whom we popularize science and technology.

In order to cater to the needs of economic construction we must put the stress on promoting the development of industrial and agricultural production in various places. Proceeding from the actual needs of the masses and the existing levels, we must publicize and introduce with definite objects in view new techniques, technologies, equipment, materials, and varieties that are worth popularizing, and offer new information, channels, and experience. In relation to scientific and technical questions that are universally present in economic construction, such as energy conservation, comprehensive utilization of raw and semifinished materials, elimination of environmental pollution, protection of natural resources, and preservation of the ecological equilibrium, we must conduct thoroughgoing and painstaking propaganda work, guide the vast number of cadres and the masses to do things in accordance with scientific laws, correct unscientific practices, and avoid making silly mistakes that will bring harm to future generations. The swift development of industry and agriculture since the 3d Plenary Session of the 11th CPC Central Committee has set new and higher demands on the work of popularizing scientific knowledge. Since the implementation of the production responsibility system in the countryside, more and more households are taking up specialized production. As a result of the vigorous development of industrial and sideline production in the rural areas, a multitude of scientific and technical knowledge is being made use of on a large scale. The reforms being carried out in industrial production and in other trades and professions in the cities will also result in an upsurge in the use of new techniques and technologies. In anticipation of this new situation, we must make preparations for doing a good job of popularizing scientific knowledge, and go deep into reality to conduct investigation and study so as to find out about the needs for scientific and technical knowledge in industrial and agricultural production. We must encourage "the promotion of science in the countryside" and disseminate to the rural areas which have a population of 800 million people scientific and technical knowledge that suits the needs of the cadres and masses there. This is a major issue which is of enormous immediate importance and far-reaching historical significance.

In popularizing scientific knowledge, we must aim at fundamentally raising the scientific and cultural levels of the whole nation and pay attention to the exploitation of intellectual resources and the cultivation of qualified people. The popularization of scientific knowledge constitutes an important supplement to and extension of school education. It is a component part of social education. With modern science and technology developing by leaps and bounds, the updating of knowledge and the reform of production techniques also have to move very quickly. Under such circumstances, even well-educated professional scientists and technicians need a constant source of new information in order to supplement and update their knowledge. Thus, reading popular science books and journals, visiting popular science exhibitions,

hearing popular science lectures, and so on become part of the regular activities of the people, including scientists and technicians.

In order to carry out socialist modernization, we must make strenuous efforts to popularize scientific knowledge. After achieving modernization, it is all the more necessary for us to persistently and extensively popularize scientific and technical knowledge. In some industrially developed nations, the governments, enterprises, schools, and institutions all pay great attention to organizing all kinds of activities to promote science. Such efforts include building museums of science and technology, publishing popular science books and journals, showing scientific and educational films and television programs, making scientific and technological productions and laboratory apparatus available to the public, and encouraging the masses to invent and create new things. In our country, science and technology have also found their way into every aspect of social life. All trades and professions must constantly absorb scientific nourishment and must disseminate scientific knowledge to the whole society and to their own staff members and workers. The popularization of scientific knowledge has become an undertaking of the whole community.

III

Under the guidance of Marxism-Leninism-Mao Zedong Thought, we must make an effort to strengthen the ideological, scientific, and artistic qualities of the work of popularizing scientific knowledge. Popular science writings must adhere to the socialist orientation. They must be scientifically accurate and free from errors and technically practicable. At the same time, efforts must be made to make them vivid and easy to understand in order to achieve good effects in society.

The work of popularizing scientific knowledge is at once scientific work and educational work. It constitutes an important component part of the building of socialist spiritual civilization. People engaged in the work of popularizing scientific knowledge are fighters marching in the van of the four modernizations. They are also engineers of the soul. In writing popular science books, we must not merely disseminate scientific and technical knowledge. We must also pay attention to introducing the achievements of socialist construction in the motherland and to publicizing the moral qualities and truth-seeking scientific spirit of scientists and technicians who have worked selflessly for the prosperity of the motherland. In this way, we can enhance people's love for and faith in the party and the socialist motherland, and encourage people, particularly youths and adolescents, to work hard in mastering scientific and technical knowledge for the socialist modernization.

In order to make our popular science writings vivid and easy to understand, we may write them in the form of literature and art so as to arouse the interest of the readers. However, we must maintain their scientific qualities. This is the fundamental requirement of all popular science writings. We may introduce to the masses questions which are still being probed into, but these questions must have scientific basis and probings must be carried

out along scientific lines with the interest of the masses in mind. We must seek authentication or approval from the departments concerned before we set out to introduce scientific and technical theories and achievements or the needs of scientists. We must seek truth from facts and leave some leeway in our appraisal. In the past, some comrades disseminated and popularized as advanced science and technology things which were immature, full of limitations, or even subjective and metaphysical. This caused us to suffer great losses. We must take warning against such things. Science fiction is very popular these days. Strictly speaking, books in this category do not count as popular science works. They do not aim at disseminating real-life scientific and technical knowledge which has been proved by practice. They are fantasies of things which do not exist in real life. This kind of creation is permitted. In writing this kind of story, a writer should aim at stimulating the imagination of his readers, bring out the vigor of revolutionary theories, and guide the readers to probe into the future along the scientific path. He must not fabricate without scientific substantiation, or violate the basic laws and knowledge of science. Fabricated stuff cannot be called science fiction.

What merits attention is that with the resurgence of the dregs of society after the decade of internal turmoil and the invasion of corrupt ideologies from abroad in recent years, some writers and editors of science fiction and popular science articles who were after "box office value" dished up some vulgar and preposterous works, even things which preached superstitious ideas, in the name of popularizing scientific knowledge. They used "scientific explorations" and "scientific imagination" as excuses to hoodwink the young readers. Some even peddled vulgar and obscene stuff in the name of disseminating the knowledge of beauty care and sex. As Lu Xun pointed out: "They dragged in all sorts of irrelevant matters and nonsense in their discussion of science. As a result, what is right and what is wrong becomes obscure. Even science itself becomes weird." ("Hot Wind": "Jottings of Random Thoughts, No 33") This kind of spiritual rubbish not only corrupts people's minds, particularly the minds of the young people and children, but discredits the popularization of scientific knowledge.

In the sphere of creative writing on popular science, we must strive to improve the ideological qualities of the works by taking Marxism-Leninism-Mao Zedong Thought as guidance. Youths and adolescents are in the stage of growth. What they need is fine and healthy spiritual food. They love popular science books, but their power of discernment is weak. People engaged in the work of popularizing scientific knowledge have the duty to supply them with the best popular science books. This is the wish of parents as well as the demand of the state. In deciding what to popularize and how to go about it, we must consider the social effects. This is the touchstone for finding out whether a piece of popular science writing is good or bad. Comrade Deng Xiaoping said: "The fundamental criterion of right and wrong in all work is whether it is conducive or harmful to the four modernizations." ("Selected Works of Deng Xiaoping," p 181) We must pay close attention to problems that concern the orientation and guide the work of popularizing scientific knowledge to advance along the correct and healthy track.

In publicizing popular science books, we must be serious and conscientious and must not go about it perfunctorily just because they are for popular consumption. In translating popular science books of other countries, we must be "selective" and make an effort to discard the dross and harmful and select the essential and useful just as Lu Xun suggested in order to truly "make foreign things serve China." We must not mechanically copy and totally accept anything which is novel to us regardless of whether it is harmful or useful. In order to do a good job of popularizing scientific and technical knowledge, we must have a fairly high Marxist theoretical level and a knowledge of the party's principles and policies in addition to having a solid scientific foundation, an intensive knowledge, and a fairly good ability of expressing oneself. On the whole, all scientific and technical workers have made some scientific attainments after years of education and practice in their particular fields. As long as they have a strong sense of responsibility and work seriously, they will be able to measure up to this requirement and become the main force of the contingent for popularizing scientific knowledge. At present, tens of thousands of popular science articles are being carried in the nation's press each year. If the vast number of scientific and technical workers do not contribute sufficient articles, there is no way that we can ensure an abundant supply of fine spiritual works to the masses of workers and peasants as well as youths and adolescents. What is worse, the market may be flooded with harmful spiritual products. Thus, we encourage scientists and scientific and technical workers to actively participate in the work of popularizing scientific knowledge, to introduce various kinds of specialized knowledge, and to report their personal experience in the practice of production and the achievements made by scientific research institutes. Many scientists of the older generation, such as Li Siguang [2621 0934 0342], Zhu Kezhen [4555 0668 2823], Zhou Taixuan [0719 1132 3763], Mao Yisheng [5403 0110 0581], Zhu Xi [2612 3156], and Lu Yudao [6392 1331 3944] attach great importance to the work of popularizing scientific knowledge. They set a good example for us by personally writing articles and giving lectures. Comrade Zhu Kezhen wrote his research findings on phenology into a popular book. Mr Pei Wenzhong [5952 2429 0022] personally wrote a report on the discovery of the Peking Man. Scientists doing the work of popularizing scientific knowledge is not only good for the masses, it is good for the development of the disciplines they are working for. Thus, when we encourage scientists and scientific and technical workers to take part in the work of popularizing scientific knowledge, we are not giving them extra burdens. It is their job to strive to win the understanding and support of the public. This is also their unshirkable and glorious duty.

We ardently hope that our scientists and all those with lofty ideals who are dedicated to the cause of popularizing scientific knowledge will actively take part in activities to promote science and write popular science books that are healthy, noble, vivid, and rich and varied with great enthusiasm and earnestness. In this way, the work of popularizing scientific knowledge will be able to play a more and more important role in the building of socialist material and spiritual civilization in our country.

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ECONOMISTS SHOULD ATTEND TO DEVELOPMENTS IN SCIENCE, TECHNOLOGY

Beijing GUANGMING RIBAO in Chinese 18 Mar 84 p 3

[Article by Ren Weizhong [0117 4850 1813] and Zong Han [1350 1383]: "Economists Should Be Concerned About the New Technical Revolution"]

[Text] There is a famous saying from Lenin: "An economist should always look to the future, should always look to the realm of technological advancement. Otherwise he will immediately fall behind" ("The Complete Works of Lenin" vol 5, p 120). These words were spoken by Lenin more than 80 years ago when addressing the slighting of technological advance and the advocation of economic stability under small-scale agriculture. When we read it today we still feel it is completely fresh and effective.

The task of Marxist economics is not just in knowing the world, but even more importantly is in changing the world; to change the world one must look to the future and concern oneself with the trends in technological developments. Over the past few years science and technology have developed quickly throughout the world. A new technical revolution is just now springing up, with electronic technology as its center, it is wide ranging, and related to all disciplines. China's grand goal of quadrupling its gross industrial and agricultural output value by the turn of the century naturally must be concerned with this question. In meeting this challenge, we must master advanced science and technology as quickly as possible, creating a technological and economic system with Chinese characteristics and enabling the development of China's economy and culture to reach the point suited to this great goal of ours. This is an urgent task that lies before us. Tremendous changes have taken place in China over the past 30 years, and in the years that lie ahead there will be even greater changes. The great strategic goals of developing socialism and the rise of the new technical revolution have brought many new problems to theoretical economics, which we need to consider and study.

Political economics is a science that studies the relation of man to man in the production process. We cannot ask that it solve particular technological problems as natural science does, nor can we ask that it study particular technological economic problems as does sectorial economics. Political economics is a theoretical science and it ought to stand somewhat higher, see a little further, and to theoretically study the objective laws of the

development of science and technology, the objective conditions for the advancement of science and technology, what changes will be brought to the relation between society and economics by the technical revolution, and how the production relations ought to serve the technological advances. If we depart from these things (of course, not only these things) in the study of production relations, if we undertake the so-called "high degree of scientific abstraction," not only is this non-scientific, devoid of content, and without aim, it can solve no problems at all, and in actuality will be of no use at all, and can even get off on the wrong track.

Realizing the four modernizations is a grand and yet arduous, complicated task, and in the process of implementing these four modernizations we will encounter a series of questions, contradictions, and difficulties that will require us to spare no effort in solving. During this, economists have a great historical mission and responsibility, and there are bright prospects. In China the new technical revolution cannot fail to bring along its own characteristics. China has a large population, a poor foundation, and the technological and economic development has been uneven throughout the various areas, departments, trades, and enterprises; China has a superior socialist system. In this kind of situation, what kind of developmental strategy for science and technology should we adopt? How should we handle the relations between traditional industry, and new and developing industries, between technologically intensive industry and labor intensive industry, between employment of labor and active utilization of new technology? How should we handle the relations among advanced technology, its economic reasonability, the suitability of its products and the possibilities of investment, between relatively developed areas and areas where industry is behind, and between developing originality and importation of technology? It would be wrong if, with these questions, we would ignore China's actual condition, purely adopting "a catching up and surpassing" or copying. We must persist in proceeding from China's national situation, and persist in the policy of being realistic and practical. But how can we implement this policy even better? In this, we have both the questions of production forces and production technology, as well as the question of relations of production. For these questions, political economics ought to provide a scientific and theoretical response.

The development of the modernization of production technology will bring changes to production scales, enterprise structures, departmental structures, and even to entire social, economic, and cultural structures. At the same time, it will be conditioned by the corresponding development and scale of readjustment suited to it of basic industry, and economic and cultural undertakings. For example, developing microelectronics technology will require the metallurgical industry, the chemical industry, the precision machining and manufacturing industry, the new-type materials manufacturing industry, as well as the tasks of scientific research and cultural education to follow closely along. The application and popularization of computers also will lead to corresponding changes in the scale of these departments and two large categories, and even in the scale and content of production, exchange, and consumption for the entire society. These kinds of changes develop in accordance with fixed rules. In capitalist countries where industry is developed there are inherent developmental laws, but in China there will be differences. Paying attention to the

laws we can see further, we can calculate and plan more thoroughly, more finely, and can avoid blindness, and can quicken the developmental pace. In studying the scale and structure of social reproduction, political economics ought to provide a far-reaching and accurate response to these questions.

The question of social conditions for advanced technology are primarily questions of relations of production and economic management. No step in the development of science and technology can depart from production relations, nor can it depart from economic policies, economic management, and economic systems. Otherwise, we can't move a single step. Presently, every trade and industry in China has a strong need of scientific and technological development, and workers, peasants, and intellectuals are constantly creating and inventing. However, because the economic system is not reasonable, the particular links in production relations and the superstructure do not meet the need of developing production forces and obstructing even quicker development of science and technology. When products and equipment are out of date, we are incapable of developing new products, new technology, and new equipment, and if developed, they cannot be tested nor put into production. After production, enthusiasm is affected because profit is often low or there is even a loss. Or, perhaps because thinking is not keen, nor knowledgeable, policies are not appropriate, etc., and things that influence technological advancement will be common occurrences. Obviously, without reform of the out-of-date economic system, without readjusting production relations unsuited to production force requirements, technological advancement will be hindered. How are we to restructure the economic system and adjust production relations? How are we to enable our form of system of ownership, pricing system, tax revenue system, loan system, fixed assets and depreciation system, product replacement system, etc., to even better mobilize all areas, all enterprises, and the broad masses to utilize, manufacture, and develop new technology and to eliminate and resist enthusiasm for obsolete technology, and to encourage even faster development of technology? Where is the crux of the problem? How ought we to solve it? Political economics ought to provide an answer.

Relations between measures in China's technological advance, the direction of development, and various sectors of the national economy ought to be studied theoretically, as should the varied social influences that could be brought along. As for the new technology of miniaturized equipment, optical fibers, biotechnology, space technology, etc., we cannot be out of touch with reality nor remain indifferent, adopt an attitude that is neither serious nor concerned, nor can we create a development that busily vies to be first, taking no need of China's particular strengths and conditions. We ought to industriously study and master advanced foreign science and technology, encourage the creativity of our workers, and create a system of advanced technology with Chinese characteristics. What the conditions are for getting to this point, and which principle limits we ought to pay attention to in regard to theory and practice, quality and quantity, political economics will provide an answer.

With the development of modern science and technology, the Western world has produced all sorts of theories regarding sociology, the future, and political economics, and among them some individual principles, materials, and plans can serve as lessons and for reference. But on the whole, these theories are

all prescriptions seeking and searching for an escape from the crisis of capitalism in order to move toward a new prosperity through a technical revolution. This is directly counter to Marxist fundamental principles. We ought to provide a Marxist dissection, analysis, and evaluation. This can both equip people's minds, distinguish right and wrong, and can in the struggle develop Marxist political economics.

What effect the new technical revolution will have on capitalist production relations, workers' movements in capitalist countries, and revolution in the Third World, what effect it will have on mutual relations between economically developed countries and developing countries, to all this political economics ought to provide a theoretical response.

Practice is the only source for theory, when theory departs from practice nothing can be accomplished; theory comes from practice, must return to practice and be served by practice. From the outset of China's undertaking of the four modernizations, in studying the problems during the modernization construction, in resolving the contradictions in the modernization construction, in seeking out the laws of the modernization construction, we have constantly summed up our experiences. In the ability to continually raise new questions, solve new problems, stimulate the advance of the great task of the four modernizations, only political economics can fully develop the function that it ought to have as a theoretical science, and at the same time only it can continually enrich and develop itself in actual practice.

Historically, all distinguished economists have paid attention to practicality, and have revered and excelled at studying great real problems. Political economics is in fact a product of social reality. The reality of the times during the transition from workshop and manual labor to equipment and heavy industry stimulated the creation of classical political economists; the actual practice of the first industrial revolution, the fundamental contradictions of capitalist society, and workers movements, stimulated the creation of Marxist political economics; when capitalism developed from free competition to monopoly, that produced the Leninist theory of imperialism. Economists believe that in the study of social economic relations, in addition to studying the contradictions between production relations and production forces, particular conditions of the development of production forces must be fully respected, and are concerned about the advancement of natural science and production technology. For example, on the one hand Adam Smith taught school and on the other he investigated the economic life of England's industrial areas. He was well acquainted with Watt and was always concerned about the testing of Watt's steam engine. David Ricardo intensively studied mathematics, physics, chemistry, mineralogy, and geology, and had his own laboratory to study electricity and light, and understood the actual progress of technical economics. It is just because of all this that they made contributions to the establishment of scientific political economics.

There is no need to even speak of the classical Marxist works. Marx not only painstakingly and meticulously dissected the contradictions and developmental laws of capitalist production methods, but also concerned himself with the important progress of research into each natural science area of his time,

from biology, chemistry, physics, and mathematics to certain particular problems in the natural sciences. Engels said: "No one could be like Marx and feel a genuine happiness for each scientific accomplishment in any field, regardless of whether or not it had practical use." "He felt that science was first of all a powerful lever in history, and felt that it was a revolutionary force of the highest significance." ("Collected Works of Marx and Engels" vol 19 p 372) From the development of mechanized heavy industry to the improvement in the degree of socialization in production, Marx saw the objective necessity that capitalism would be replaced by socialism.

Engels was very concerned with technological advances. On the basis of studying the newest achievements in the natural sciences and in the social sciences, he wrote the immortal masterpiece "Natural Dialectics." At the time when electric power was just appearing, he foresaw the social consequences that would arise after its development, and pointed out: "This is truly an enormous revolution," and would "abolish the antithesis between town and country," "and will even result in the management of production forces by the bourgeoisie being less and less competent" ("Selected Works of Marx and Engels," vol 4 p 436).

From the contradictions between technological advancement and the capitalist system, Lenin saw the tendency for the concentration of capital and monopoly to occupy the controlling position, and saw that the decadence of capitalism and imperialism was the eve of a socialist revolution. After the October Revolution, Lenin paid even more attention to the role of science and technology in economic construction, and personally took charge of drawing up plans for electrification and proposed the famous formula that communism is Soviet governmental authority plus national electrification.

After Comrade Mao Zedong had finished transforming the basis of socialism, he issued a great call to the whole party and the entire country to march toward science and technology and to develop technological innovation and technical revolution. China's older generation of revolutionaries, scientists, and economists were also very concerned about the development of China's production forces and science and technology. For example, what was valuable about the economic viewpoint of Sun Yefang [1327 0396 2455] was in that he cared about technological advancement and opposed the outmoded customs and bad habits that hampered technological advancement. He opposed reproducing antiquity and advocated arming contemporary enterprises with the newest technology to improve economic results.

Today we are involved in a socialist modernization construction never seen before, and economists must be in even closer contact with reality and be concerned about the development of production forces. If we want to accomplish what we try, and not fail in what the people have entrusted with us, then we must participate in the actual practice of the four modernizations, understand conditions, take charge of progress, research problems, and propose constructive measure, theories, and ideas in the meeting of theory and practice. We must participate in decision making, and give full play to the proper role of political economics.

Economists must face the future, face technological advancement, as they will be faced with even newer questions for their knowledge. They not only want to understand social science, understand philosophy, but should also grasp mathematics as well as have a certain knowledge of natural science. If one does not understand mathematics, nor the basic principles of natural science, then that will limit the development of one's own talents. For all those who have the qualificiations, it would be best to study these subjects.

When world science and technology was advancing so rapidly in the 60s and 70s, the development of China's science and technology missed the opportunity due to the disruption by "leftist" thinking, which increased the gap with the world's advanced levels. Now, under the correct leadership of the Central Party we definitely want to seize the opportunity, try hard to catch up, and allow China to enter even more quickly the world circle of countries strong in economics and technology.

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NEW METHOD OF SCIENTIFIC RESEARCH INVESTMENT DISCUSSED

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[Article by Li Xingquan [2621 5281 2938], Mu Suping [4476 4790 1219 and Yu Shichen [0205 0013 3819] of the scientiology section of the Beijing Municipal Scientific and Technological Information Office: "Change the Method of Scientific Research Investment and Improve the Economic Results of Scientific Research"--Responsible editor of this article is Chu Xiao [0443 2556]

[Text] Judged from the economic point of view, the major characteristic of science is efficiency. The purpose in constantly exploring the method of scientific research investment is to increase the wealth of society and improve the economic results of scientific research. In light of China's national conditions and the current situation in the S&T field, this article suggests the following measures of reform: Practice economic accounting and make appropriations based on projects and, on the basis of a remunerative contract system, exercise comprehensive contract management in China's scientific research institutes. This will fundamentally change the relation between the state and scientific research units.

I. Along with the emergence and development of modern science and technology [S&T] and the industrial revolution, S&T have shifted from the sphere of knowledge to the sphere of productive forces. S&T development and application are growing closer and closer to the economic activities of mankind. They have become a predominant factor of economic growth.

Judged from the economic point of view, the major characteristic of science is efficiency. Today creative scientific labor is the labor that has the most potential and can create the highest economic value. Therefore, seeking economic results, namely studying the issue of multiplying the results of scientific labor, becomes the key objective of the economics of science. This is why all developed countries in the world consider S&T to be a key means and effective way to improve economic results and increase the wealth of society. This is why they continuously explore the best form of scientific research input and the utilization of invested resources. Even under the condition of socialism, the results of most practical and developmental research projects have the nature of general commodities. They have value and use value. They can be used in the process of production and consumption by means of exchanges

to meet the growing material and cultural needs of society. Therefore, research institutes, must utilize not only the law of scientific research but also the law of economics, especially the law of value. They should not only create research results and train competent personnel but also create economic results and voluntarily adapt their work to economic construction. The economic relations between the state and research institutes and between enterprises and independent research units should essentially reflect the principle of the exchange of equal value. This is of course what we use as a basis in discussing the economic mechanism among them, especially the issue of fully utilizing the means of investment.

In scientific research investment, China basically uses the method that was used by the Soviet Union prior to the 1960s. For a long time, all independent scientific research units depended only on unified appropriations under the state budget to cover their operating costs. The state budget covered the expenses of all research institutes and all research employees. The distribution of scientific research investment was based on the practice of "eating from the same big pot." Research units had no economic responsibility. Other units did not have to pay for the use of S&T results. This is an extremely important cause of the severed link between scientific research and production and the low efficiency and poor economic results of scientific research. Therefore, it is of great significance to study and change the method of state investment in scientific research projects, allocate funds in accordance with scientific research projects and on the basis of establishing a remunerative-contract system, including vertical and horizontal contracts, conduct economic accounting to improve the social economic results of scientific research.

According to studies, the earliest scientific research contract was designed by C. E. Williams, second director of the U.S. Battelle Research Institute in 1934.[1] His basic method was to sign a contract with a certain unit to carry out a certain research project. All expenses involved will be borne by this unit and the research result will belong to this unit. Without the consent of this unit, the research institute could not publish, reveal or transfer the possession of the research result. In order to evoke the enthusiasm of private enterprises for research and development, this method developed to such an extent that the state would provide funds for enterprises to do research on a contract basis and share with them or let them have the research results. This method of allocating funds according to projects and working on a contract basis made it possible to consider the utilization of research results at the very start of investment.

In 1961 the Soviet Union began to change the method of depending only on state budgetary appropriations and added two sources of money supply: One was the contract fund of enterprises and the other was the unified scientific research fund of departments and committees under the central authorities. Romania also changed the method of depending only on state budgetary appropriations. In 1970 it began to adopt a scientific research contract system. In recent years, it practiced a general contract system requiring scientific research institutes to assume, step by step, sole responsibility for their profits and losses and take care of their economic problems themselves.[2] In 1960 Czechoslovakia began to use economic means in the field of scientific

research and started to reform the scientific research system. At present, 89 percent of all units in Czechoslovakia engaging in the research, manufacture and designing of applied sciences have assumed sole responsibility for their own profits and losses.[3] Other East European countries such as Hungary, Poland and the German Deomcratic Republic have also adopted the method of allocating funds according to remunerative contracts.

After changing the method of scientific research investment, the aforementioned countries have all achieved fairly good results. For example, the direct result created by the reform of the method of fund allocation in Romania is the improvement of the utilization rate of scientific research results. During its 5-year plan period from 1976 to 1980, over 10,000 scientific research results were utilized; over 5,000 new materials and consumer goods were produced; and 9,000 new technology items were applied.[4]

In 1979 China began to practice the remunerative transfer of research achievements, to carry out on a trial basis scientific research responsibility systems, S&T and technical contract systems, to organize technological exchange and trading activities and to offer S&T consultative services. Because of this, the proportion of S&T achievements transferred into direct productive forces and the economic results created by such transfers are both increasing in China. According to incomplete statistics compiled by some research institutes in Shanghai, when research achievements were free their transfer rate was 35 percent; since they became remunerative, their highest transfer rate was 85 percent.[5]

In sum, since the situations in different countries and scientific research institutes are not all alike, it is difficult to follow a unified model. However, what we are confronting is a matter of practical significance; that is, to increase the social economic results by changing the method of investment and practicing economic accounting and the remunerative contract system to reverse the situation in which all independent scientific research institutes depend only on the state funding to cover their operating expenses.

II. In light of our national conditions and the current situations in the sphere of scientific research, we suggest that we reform the method of scientific research investment, practice economic accounting and allocate funds according to projects and exercise comprehensive management on the basis of a remunerative contract system. The basic content of this reform is to change the current vertical state budgetary appropriations for the oeprating expenses and the three S&T costs of independent scientific research units into the allocation of funds for remunerative S&T contracts. Whenever the state needs and approves a project, it will sign a contract with a research unit and provide it with S&T operating funds, wages and a certain amount of profits. Otherwise, it will not make any appropriations. Appropriations or subsidies for the research of basic theory or for those practical and developmental projects which yield great benefits to society should all be given in the form of scientific research funds according to the contracts. The current horizontal contract system should also be changed into a remunerative contract system. This will put the state in the position of a consumer and buyer, thereby fundamentally changing the relations between the state and scientific research units.

Expenses covered by remunerative contracts include not only material consumption (electricity, water, communications and transportation costs) but also the consumption of living labor (wages, managerial costs and welfare funds for personnel undertaking the project), the amount of profits allowed by state policies, equipment and instrument depreciation charges, risk and loss compensation, the share of tax payments, and the investment in large equipment and capital construction. General remunerative contracts signed with enterprises and institutions should also include terms corresponding to what we stated above.

From this, we can tell that the reformed remunerative contract system is different from the original practice of state appropriations for S&T operating expenses. It is also different from the comprehensive contract of the S&T responsibility system. It is basically different from current vertical contracts, the transmission of appropriations for research projects from one level to another and general horizontal remunerative contracts.

Adopting this remunerative contract system does not reject state budgetary appropriations for certain fields such as basic theory, public health and medical undertakings, special investment in major state projects and interdepartmental projects, free subsidies for those newly-developed fields and projects and interest-free and low-interest loans provided by banks. On the contrary, adopting this system demands the strengthening of corresponding measures. The purpose in reforming the method of appropriations is not and should not be reducing state investment in scientific research. The main purpose should be effectively utilizing our limited amount of investment, which is growing continuously as the national economy develops. The state and enterprises should both invite tenders to finance those projects with good prospects, personnel with research ability, projects that show promising signs and organizations with good credit. They should become shrewd users, "buyers" and "investors." They should guarantee that when they put in a limited investment, they will hear "echoes," loud and clear. At the same time, it is necessary to open up sources of scientific research operating funds and raise funds through multiple channels (such as state budgetary appropriations, special investments, scientific research fund subsidies and bank loans). It is also necessary to promote the integration of scientific research and the economy and establish a link between research and development work and production. This will make the research acitvities of scientific research units more purposeful, increase the social economic benefits of scientific research projects and enable scientific research units to pay for their corresponding expenses and acquire scientific research development funds.

Obviously, under the so-called remunerative contract system, scientific research units negotiate and sign contracts with users (the state and enterprises) which include lucrative conditions, technological and economic responsibility and time limits for the completion of projects. This kind of contract should have certain legal restrictions and is in principle applicable to all research, designing and development institutes. However, since practical developmental research and experimental and designing activities have relatively few unknown factors, their "research-production" cycle is shorter, their research results are easily transferred to direct productive forces and their microeconomic and macroeconomic results are mostly fairly obvious, it is possible to set clearer and more specific targets for the contracts before the projects begin. Therefore, we might as well start our exploration with the field of industrial research.

In the past few years, along with the reform of the economic system, the national economy has begun to change to a course based on improving economic results. The planning of national economic development takes the form of guiding plans with the supplement of market regulation in addition to the form of command plans. Enterprises are becoming relatively independent economic entities and are changing step by step from a pure-production type to development-production-management type. This causes them to confront the challenge and competition of basic quality, standards and efficiency. The essence of this competition is S&T and the managerial level. This in turn causes enterprises to increase their objective needs for utilizing S&T, including managerial skills. Enterprises have implemented various economic responsibility systems and the tax-for-profit system. They are beginning to have the ability to purchase advanced technology. In order to encourage the technological progress of enterprises, the state has clearly stipulated in policies that in addition to development, collective welfare and bonus funds, enterprises are now allowed to retain profits for another fund--the new product trial production fund. The state permits enterprises to use a certain portion of their output value or sales value to pay for their expenses in technology development. This makes it possible for enterprises to raise funds through multiple channels and use them to purchase or develop new technology.

Adopting the remunerative contract system is an objective need of society. Some scientific research units have prepared certain conditions for adopting this system. In the past few years, along with the reform of the economic system, S&T departments have also carried out on a trial basis economic accounting for individual projects, contracts for single-item projects, remunerative transfers of research results and multifarious responsibility systems such as the scientific research responsibility system, the S&T economic responsibility system, and the technological and economic contracts. Although these systems have different names and contents, they still helped S&T departments initiate extensive use of economic means and accumulate rich experiences by conducting a large amount of infrastructure work, such as statistics and analysis. In recent years, the state began carrying out on a trial basis such measures as transmitting allowances for major research projects from one level to another, gradually reducing regional and departmental allowances for scientific research operating expenses and increasing the allowances for special use of research projects. At the same time, the state also extensively adopted a remuneration system concerning the horizontal assignments of scientific research projects and experimented with technology transfers in selected units. Judged by the situation throughout the country, many practices are still purely theoretical and doctrinal, but this is a good beginning. Many regions, trades and units have already shown good results. This has paved the way and laid a fairly good foundation for adoption of the remunerative contract system.

III. Although we have enacted quite a few experiments in the reform of the economic system, to adopt the remunerative contract system we must continue to do more work in creating macroscopic and microscopic conditions.

A. Macroscopic conditions:

The reform of the appropriation method is a comprehensive reform of fundamental significance. First of all, enacting this reform involves fundamental reforms

in certain fields of many departments such as state planning, economic, financial, labor personnel, educational and banking departments. Therefore, we should have the state formulate corresponding laws and rules and regulations, make unified plans and arrangements and coordinate all departments to enact this reform. Before an overall plan is drawn up, we should carry out experimental work but not in the traditional way which is to have different departments, trades, provinces or cities each select a few pilot units and carry out experiments separately. Instead, we should regard every province, municipality, autonomous region or province-administered city as a unit, authorize localities to devise local plans as practiced in special economic zones and carry out unified comprehensive experiments.

Second, the key to this reform is to change the relations between the state and research units. This is not only a change of certain systems but also a change of concept. The practice of relying only on relations between higher and lower levels and arbitrary decisions made by a few people or individuals without fully utilizing professional managerial organs and personnel and without following a complete set of sound management procedures are no longer desired. At present, a considerable number of projects are proposed by research institutes themselves and approved by their higher-ups without changes. These projects are not carefully examined and analyzed; nor do they have a prospective subject or target of utilization. Some units make blind selection of research projects and are careless about their policy decisions. Some do not even know how much a project will cost. Because of this, pertinent departments and commissions should guarantee the unified utilization of all expenses needed in the "research-utilization" process by setting up corresponding S&T funds in light of the amount of profits retained by the enterprises under their jurisdiction or the amount of the state budget they receive. They should also establish corresponding organs, formulate scientific procedures for examination, policy-making, planning, implementation, supervision and control are gradually included in a scientific course.

Third, to enact the remunerative contract system, an important condition is that enterprises should have objective needs as well as the ability to adopt and purchase technological achievements and to actively participate in exchanges on technology markets. This requires us to formulate and conscientiously implement a series of economic policies while changing the relations between the state and enterprises and making enterprises relatively independent economic entities. For example, we should formulate and implement policies to give great reward and preferential treatment to units and individuals who have made contributions to technological progress; policies to raise the depreciation rate of fixed assets, to increase the share of profits for development funds and to increase enterprises' decisionmaking power in technical innovation and transformation; policies to set high prices for high quality products and punish enterprises for low quality; and policies to reduce or deduct taxes levied on new products. We should give enterprises both pressure and power through price readjustment, profit-sharing system and market competition.

At the same time, we should draw up regulations for implementation of the remunerative contract system, quicken the pace in establishing the patent system, devise policies to encourage and support scientific research units implementing the remunerative contract system and provide further legal protection for the reform of the method of scientific research investment.

B. Microscopic conditions:

At present, scientific research institutes have very limited decisionmaking power. Scientific research responsibility systems cannot fundamentally solve this problem. To reform the method of investment and enact the remunerative contract system, the primary microscopic condition is to make scientific research units relatively independent entities. Moreover, research units must have sufficient research ability. As far as present local research institutes are concerned, there are serious shortages in the supply of manpower and material and technical conditions. Improvement in this regard is urgently needed.

First of all, it is necessary to expand the sources of assignments. Local research institutes have very few vertical assignments. According to statistics compiled in 1982 by 77 independent scientific research institutes under the administration of Beijing Municipality, the number of scientific research projects assigned by higher levels was less than half of what they expected. Among them, 20 institutes received less than 30 percent of what they expected. If they rely on horizontal contracts, they will have problems transferring their research results, because enterprises do not have very much pressure and power to adopt S&T achievements. Those trades and professions whose products are in great demand especially lack an interest in adopting S&T achievements. Most scientific research units are "starving," If they rely on income from horizontal and vertical contracts without state allowances to cover their operating expenses, they can hardly guarantee that they can make enough money to keep their "shops open." Judged from this, there is still a long way to go in increasing the actual needs of the state and enterprises for S&T.

Second, it is necessary to improve material and technical conditions. Local research institutes are mostly developmental research institutes, but they have very serious shortages of corresponding material and technical conditions, especially conditions needed for intermediate testing. Of the 77 research institutes in Beijing, only 26 conducted trial-production of products in 1982. Under the "supply system," they can manage to make ends meet; otherwise, they cannot survive. Therefore, when enacting the remunerative contract system, the state should give energetic support to research institutes in capital construction and fixed-asset investment and help arm them step by step to achieve a benign circle in which they have surplus funds after paying for their expenses and are able to increase scientific research development funds every year. This will provide a guarantee for the continuous development of scientific research undertakings.

Third, it is necessary to have a capable and rationally structured research contingent. To enact the remunerative contract system, we must improve various structures of the scientific research contingent to bring into full play individuals' active functions and group effects. As for those who are not suitable to work at scientific research units, corresponding departments should take responsibility to transfer them out of research units or assign them different jobs. If we cannot even solve the problem of "idlers," we certainly will not be able to have a solid basis for discussing such issues as rationalizing the relocation of S&T personnel and improving the structure of scientific research contingents and the quality of S&T personnel.

We need to make great efforts to solve these problems so as to create good conditions for reforming the method of scientific research investment.

IV. In the process of formulating a remunerative contract system, an important and complicated issue is to set prices for scientific research results. Due to the particularity of scientific labor, it is very difficult to make accurate calculations and estimates of scientific research results, and there are no unified market prices. In socialist countries, the general principle is to give due consideration to the interests of researchers and producers and give material benefits to both sides on the prerequisite of increasing the economic results of society and satisfying other social needs. Such benefits should be specified through negotiations and agreements between both parties. At present, there are two general ways to solve the price problem:

One is to price S&T results according to their value--roughly considered to be the general production cost plus a certain amount of profits. The production cost includes three major categories: 1) costs of raw materials, fuel, power, water, electricity, communications, transportation, technological information, equipment and instrument depreciation, external coordination, large equipment and laborabory facilities and capital construction investment; 2) the share of wages of research and managerial personnel and their welfare and labor protection funds; and 3) the share of general risk and loss compensation and tax payments. The amount of profits is fixed mainly according to the degree of difficulty, estimated economic results and life-span of S&T results.

Therefore, we will have roughly three kinds of contracts:

The first kind does not include profit targets. In other words, the price of research results includes only the total cost of production. There are two situations: 1) The total cost of production is borne by the unit which makes the request for the research project and the price of the project is not difficult to calculate if it is not very complicated. 2) Both parties share the expenditure of the project. In other words, their investments are in proportion to the profits they will receive.

The second kind includes profit targets. In other words, the price of research results is production cost plus profits. There are two situations here, too: 1) production costs plus a fixed amount of profits and 2) the price of research results being fixed and specified in the contract. Under the second circumstance, research units will try in every way to reduce the production cost so they can gain more profits. But they will have to bear risks.

The third kind includes bonus targets or both bonus and profit targets. There are two categories: 1) Fixed price plus bonus. Contracts under this category use estimated costs and profits to set the price of research results. If actual costs and profits are higher or lower than their estimates, the surplus or deficit will be paid according to different percentages. 2) Production costs plus bonuses plus profits. Contracts under this category not only include estimated costs and profit targets but also set ceilings and floors for the profits of research units. If actual profits are higher than

the ceilings or lower than the floors, profits will be given to research units according to the fixed ceilings or floors. If actual profits are between the ceilings and floors, research units will receive a percentage of the amount of production cost they reduced as their bonus. This kind of contract is suitable for projects where production costs cannot be accurately estimated.

Based on the theory that "complex labor equals several times simple labor," and because there are great risks involved in scientific research profit rates, even the lowest, must be slightly higher than the average profit rate of social labor in the field of material production. Currently, the scientific research profit rate is set at 6 percent in the Soviet Union, 10 percent in Czechoslovakia, 20 percent in Romania and Poland and 5 to 40 percent in the German Democratic Republic. May we temporarily set it at 10 to 30 percent? This question needs to be further explored in future practices.[6]

Another way of pricing S&T achievements is to use the use value as a basis for setting prices. In other words, within a given period of time, research units will receive a certain percentage of sales value or profits gained by enterprises as a result of utilizing research results. The percentage of profit-sharing ranges from 5 to 20 percent and the percentage of sales value ranges from 1 to 5 percent. The time period is usually within 3 years. This method will make both sides share the risks and pay attention to the effect created by transferring S&T results into productive forces. Therefore, it will help hasten the materialization of S&T achievements.

Changing the method of scientific research investment and improving the economic results of scientific research are a measure of reform which has fundamental significance. We should continue to explore, sum up and improve this measure by carrying out experimental work in selected units so as to make China's reform in the scientific research system develop in depth and achieve practical results.

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12302
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IMPORTANCE OF LEGAL SYSTEM TO DEVELOPMENT OF SCIENCE, TECHNOLOGY

Beijing ZIRAN BIANZHENGFA TONGXUN [JOURNAL OF DIALECTICS OF NATURE] in Chinese No 2, 10 Apr 84 pp 39, 9

[Article by Sun Haohui [1327 4110 2547] of the Northwest Institute of Political Science and Law: "Science and the Legal System"]

[Excerpt] It is my view that the reason why historically science and technology have developed slowly in China is because there has not been any social mechanism that stimulates scientific activities. In other words, China does not have the kind of social dynamism that can bring about a spurt in scientific development. The brutal forces generated by science pushed the Chinese people into accepting existing Western science and technology. But because China did not have the kind of social conditions that could develop modern science, modern Chinese science and technology bears the strong mark of a transplant. Numerous well-meaning Chinese intellectuals, while unaware of the social factors in scientific development, propounded the slogan "save our country with science" simply on the basis that China needed science. They devote themselves to studying Western science and technology, but the seeds sown in this barren land could not grow into strong trees. The tradition of dictatorship by rulers proved the slogan "save our country with science" to be nothing but wishful thinking. For the dictatorship of feudalism or semi-feudalism could never initiate social demands for science through the improvement of production modes and the stimulation of an interest in science. Sciences not originated from social demands will definitely die out by themselves. Basically, the development of science and technology in an ancient civilization such as China's cannot take place unless the society itself undergoes fundamental changes. Social conditions will forever be determinant factors in the initiation of science.

Our history has shown that the changes which have taken place in production modes have greatly stimulated the development of science and technology. But history progresses at a much slower pace than people are aware of. Why? Historically there has been only one answer: changes in production modes alone cannot bring about direct dynamism in all aspects of society; in order to witness a spurt in the development of science, we must create a concrete social mechanism.

This social mechanism is the concept of the legal person and the patent system. In a socialist country such as China's, the essence of establishing the concept

of the legal person provides a legal organizational form for fostering the autonomy of enterprises. The establishment of the concept of the legal person causes direct relations between the working masses and the economic profits generated by the property of the enterprises, thereby stimulating the creativity of labor and managers, and they will willingly modify the conditions of production to increase output. This kind of change will definitely result in strong demands for science and technology, and the employment of science and technology provides the development of science and technology with material means.

The establishment of the patent system offers direct profit motives for scientific activities. For scientific inventions are the products of labor, the kind of labor that is beyond a fixed quota of labor. Therefore, the inventor can never receive proper reward for his productivity from his normal wage. The system "to each according to his work" demands that this kind of labor beyond a fixed quota be rewarded with more than the average wage in society. This kind of economic relationship demands as reflected in the superstructure the patent system. Thus, we hold that the establishment of the patent system in China is historically inevitable.

The interaction between the concept of the legal person and the patent system will undoubtedly provide a direct mechanism for a spurt in scientific development. Therefore, we contend that the development of science in China is one of integration between science and the legal system.

We have studied the inner links between science and the legal system, and have thus developed a collective awareness: scientific activities that give us the knowledge to transform the natural world, relies on the profit motive within the social system; the better the profit the more vigorously scientific activities will take place. On the other hand, the improvement of the legal system which can directly better the immediate surroundings of individuals relies on scientific social awareness generated by the development of science and technology. Therefore, science and the legal system should be the guidelines of our age, and they will urge us to work hard for them.

12680
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NEW REGULATIONS FOR SCIENCE FUNDING

Beijing RENMIN RIBAO in Chinese 6 Mar 84 p 3

/Article by Ke Jin /2688 6855/: "Chinese Academy of Sciences Has New Regulations for Science Funding and Management"/

/Text/ The recently convened Third Conference of the Science Funding Commission of the Chinese Academy of Sciences resolved that starting in 1984, the direction of science funding would give priority support to practical research on basic subjects which are of major significance in economic construction.

The conference issued some new regulations concerning applications for and management of science funding:

1. In order to benefit the discovery and training of human talent, for midgrade and lower scientific and technical personnel, applications for science funding now need recommendations from two assistant professors rather than two full professors, and recommendations are not required when upper-grade scientific and technical personnel participate in the research.

2. Following a suggestion from the Science Funding Group of the Biology Division, there was agreement that there no longer would be any individually established minor subsidies, and that priority support would be given to middle-age and young science workers performing significant exploratory research.

3. Active support will be given to the applications from border area science and technology workers, and they are especially encouraged to conduct systematic, specialized research work which unifies local natural conditions with the special features of the natural resources.

4. A responsibility system for applicants will be implemented, and the units will supervise and guarantee the use and management of science funding. Regarding the topics for applications from the units, the applicants' own units should conduct a sincere investigation and screening, overall planning for scientific research, teaching and other tasks, achieve a balance of manpower and materials, provide complete guarantees of the requisite work conditions for the subjects of the science funding and subsidies, and moreoever supervise the activities. The applicants bear full responsibility for accomplishing the research tasks, and simultaneously have authority to select the personnel constituting the

research group, authority to formulate the research plan, authority to direct the research work, and authority to report the research results, as well as authority to control expenditures according to the financial regulations stipulated for science funding.

5. The cutoff date for accepting completed topics for review and handling for the current year has been moved up to 31 March from the original date of 31 May.

11582
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MOBILIZE RETIRED SCIENTISTS, TECHNICIANS TO SERVE FOUR MODERNIZATIONS

Guangzhou YANGCHENG WANBAO in Chinese 25 Jan 84 p 2

/Article by Zhu Shu /2612 2579/: "Mobilize the 'Remaining Enthusiasm' of Retired Science and Technology Personnel to Serve Construction of the Four Modernizations"/

/Text/ Bringing foreign retired science and technology personnel to work in China and help with construction of the four modernizations is an effective device for solving China's serious shortage of scientific and technical human talent. This is especially true in the assimilation and absorption of certain imported technology and equipment which is highly advanced and complex. Moreover, the use of this foundation to develop technology and equipment that suits our conditions and trains our current crop of science and technology human talent is a way to get twice the results with half the effort. In the same fashion, in these new conditions, another question which ought to be given serious consideration is how to thoroughly tap and utilize the strength of the domestic broad retired science and technology personnel.

Foreign retired science and technology human talent has definite advantages, such people have relatively better comprehension of advanced scientific and technical knowledge, an area in which our domestic retired scientific and technology personnel compare unfavorably. However, it must be seen that our domestic retired science and technology personnel also have certain advantages, they are natives and more familiar with conditions in China, an area in which the foreign retired science and technology personnel compare unfavorably. Both issues are important and ought to be combined.

Domestic retired science and technology personnel have generally worked several tens of years and have a certain degree of professional and theoretical knowledge and relatively abundant practical experience, they have had numerous successful experiences since the founding of the nation and also have learned from failure, and they have relatively extensive experience with socialist construction. They all hope that during their lifetime they will be able to continue to work for the nation to the extent of their ability and to contribute their "remaining enthusiasm" to construction of the four modernizations. Such hopes as these should be fulfilled, and it also suits the current need in matters of national construction.

Mobilization of these domestic retired science and technology personnel to serve construction of the four modernizations must of course base work assignments according to certain characteristics. One such characteristic is advanced age and a lack of mobility, so that they generally will be unable to sustain a heavy work load for a daily 8 hour schedule. However, they by no means have completely lost the ability to work and some are still very healthy and can work for a certain time on a daily basis. A second characteristic is that they generally have relatively abundant work experience and social experience, which is a truly valuable intellectual resource. They can provide advisory services for party leading organs and for plants, mines and enterprises; they specially can provide scientific and technical services for mid and small sized enterprises; they also can make translations, do technical training, work on key technical problems, write books and theorize; they even can assume the task of planning programs, projects and products and can perform tasks of examining and verifying blueprints. Their work fills the role of making up for omissions and deficiencies and provides very broadranging services. The retired science and technology personnel also have superiorities that currently employed science and technology personnel generally do not have. Because they already are retired they have relatively detached status and are less subject to various connections, so they are able to give somewhat more suitable opinions in the task of giving advice on science and technology.

If the retired science and technology personnel are organized they can perform an even greater role. Take the Guangzhou city Association of Retired Engineers for example, this association has been established for 2 years and now has a membership of nearly 200 people, with over 40 percent of them senior level engineers. It is complete with civil engineers, electrical engineers, light industry engineers and chemical enginers of all types and fields, so that it is characterized by professional diversity and overall strength. Permitting them to align themselves with society and join with industries and enterprises by performing feasibility studies and solving technological problems will make them into technical advisors and assistants for the party and government leadership departments and for the mines, plants and enterprises as well. The Chongqing city Association of Retired Engineers had a relatively early start in such work and their successful experiences can serve as a model.

No small number of people lack adequate understanding of the function of the retired science and technology personnel. Some people say that "since they are retired, this means they cannot continue to work," and consciously or otherwise they place various restrictions on continued work by retired science and technology personnel. These comrades do not realize the serious shortage of science and technology human talent in China, they do not understand the special need for full mobilization of the forces of the retired science and technology personnel in serving construction of the four modernizations. Take the conditions in Gunagdong for example, neither the quantity nor the quality of the science and technology personnel are suited to the construction tasks, and this is especially serious in the towns and villages and the broad countryside. The collapse of the seven-story building in Haikang county was purportedly because an assistant engineer was in charge of the design. Generally speaking, assistant engineers cannot carry out design work independently but must work under the supervision of an engineer. This is an obvious example of the shortage of scientific and technical human talent.

Some people are worried that if retired science and technology personnel continue to work they will then have excessive income, but such fears are groundless because suitable policies will be employed. One simply cannot give up eating for fear of choking. Thorough investigations will be made in order to make the necessary regulations and formulate a workable policy to cover such areas as the organization and management, scope of service, time of service and standard of compensation for the retired science and technology personnel.

11582
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SCIENCE AND TECHNOLOGY SERVE ECONOMIC CONSTRUCTION

Wuhan HUBEI RIBAO in Chinese 14 Feb 84 p 2

/Article by Cao Ye /2580 6851/, secretary of the Hubei Province Science and Technology Party Leadership Group: "Persistently Implement the Policy on Gearing Science and Technology to Economic Construction"/

/Text/ We live in an age where world science and technology are making enormous progress and the science and technology workers are faced with awesome responsibilities on the long road ahead in accomplishing numerous tasks. However, at present, the most important and the most outstanding tasks are to staunchly carry out the fundamental policy of economic construction based on science and technology and science and technology geared toward economic construction.

This fundamental policy correctly reflects the dialectical relationship between vigorous development and progress in science and technology and reflects the laws of development in economics and in society. This policy is not limited to scientific and technological work but is a fundamental policy for construction of modernization in China. The correctness of this policy not only provides practical assurance for our socialist modernization, but also is confirmation of the history of economic development in the modern world. Since the middle of this century, every area of science and technology has experienced a profound revolution. New sciences constantly emerge, such scientific accomplishments as information theory, systems theory and control theory provide mankind with ideological and social influences, and the three great scientific accomplishments of the 19th century cannot be compared with them. Science and technology are the golden key for mankind to understand and transform nature. The more that mankind has a grasp of the laws of the world on a worldwide scale the more he will be able to comprehend the laws of matter on an even deeper level. Great increases in and a profound transformation of human understanding will definitely lead the production forces in taking giant steps.

What makes us happy is that more and more people are coming to realize that progress in science and technology is the road which must be taken in enlivening the economy. The "science fever" which occurred just after agriculture implemented the responsibility system linking planned production to contracts vividly reflects the new ideological awakening of the peasants. This new awakening together with study and control of the level of science and technology in agriculture will determine the speed of agricultural development. The

specialized households which are springing up like wildfire will lead the people to prosperity through labor, and, simultaneously, the majority of them are seekers, examples and transmitters of science and technology. With prompting from them, reliance on the popular dissemination of science and technology will bring about a wider use of the diverse economic resources of the plains, hills, grasslands and mountains, and will permit greater depth in opening up more levels of comprehensive utilization and cyclical utilization, as well as obtain even better ecological and economic results. The major problem of transforming the low economic efficiency of our current industries also depends to a great extent on scientific and technological progress. In order to narrow the distance between the developed nations and ourselves, we must make full use of the results of foreign and domestic advanced technology, renovate outmoded technology, transform backward technology, and, simultaneously and as quickly as possible, we must also open up new areas of production and develop new departments of technology and industry. Only by turning the entire national economy toward a modernized technological foundation is there any hope for an awakening of our economy.

Accelerating scientific and technological progress and promoting realization of the strategic goal of quadrupling the gross output value in industry and agriculture by the end of this century are the historical tasks shouldered by science and technology workers. The focus of our work and our main energies ought to be placed in the area of services to economic construction. Without question, our party has always valued theory and emphasized basic research. The basic research that has the potential to produce important results for the long term development of our national economy, and the basic research wich is directed toward the special feature of our province's natural conditions, as well as basic research which has major scientific significance should continue to receive serious consideration and support to enable it to have stable development. However, at present, applied research and developmental research are the most urgently needful of the greatest amount of strengthening. Science and technology workers must be concerned with economics, understand the necessity of economic construction, improve their awareness of economics, and quickly improve their capabilities in resolving major questions in economic construction. During the major technological transformation of important construction projects in the national economy and in the traditional industries, in such areas as the formation and development of new style industries and in the assimilation and recreation of imported technology, everything has a series of scientific and technological problems which await our resolution. In order to transform science and technology into production forces, it is necessary to work closely at expanded application of the accomplishments of science and technology. It is necessary to organize the transfer of advanced technology from the research laboratory to the factory, from army engineering to civil applications, from the seacoast to the interior, and from foreign countries to China. Science and technology workers must open up their field of vision, pay close attention to the major trends in the world's scientific and technological developments, be skilled in importing and absorbing all scientific and technological developments throughout the world, and be skilled in taking the best in all the world for our own use. In awakening the economy, it is necessary to skip over the method of developing some traditional industries and directly import and utilize technology of the new era and form new production and economic categories. We

need only concentrate on making a rational unification of advanced technology and economics, which means that we must be realistic and have foresight and sagacity, so that we can then forge a new road of economic awakening which relies on technological progress. In facing up to the situation of technological revolution throughout the world, it is necessary to give emphasis to providing leadership for the whole province by utilizing the concentration of intellectuals and the human talent in the key city of Wuhan, energetically research, disseminate and make applications of developments in microelectronics technology, information technology, biological engineering and new types of materials, all in order to promote great advances in our production forces. Regarding the strategic issue of economic and sociological developments, science and technology workers must operate from a multidiscipline, joint investigation foundation to provide scientific proof and actively participate of their own volition in the policy-making process. Regarding the issue of the science and the technology now in the process of development, it is necessary to broadly develop information, technical and advisory services. The popularization of scientific and technological knowledge to the broad urban and rural masses is a major strategic path. The establishment of science popularization centers having special features and economic substance is an effectively way to actively propagandize and educate the masses. Under modern conditions of scientific development and technological progress, the energetic exploitation of intellectual resources is the foundation and premise for developing other resources.

Implementing the turn toward economics of science and technology also requires the implementation of the essential reforms in the organizational system of science and technology, and moreover requires implementation of the policy on intellectuals. The reforms ought to encompass consideration of two basic issues: one is to help in overcoming the separation between scientific research and production; the other is to provide more help in utilizing the role of human talent. Recently, Comrade Deng Xiaoping placed special emphasis on the need to carry out the policy on intellectuals, make even better use of our present human talent in science and technology and carry out essential improvements in the material conditions of the intellectuals; but if is especially important to create throughout the whole society an atmosphere of respect for knowledge and respect for human talent. With approval from the State Council, the State Science and Technology Commission suggested six policy limitations, such as antispiritual pollution, that should not be exceeded in natural science and technical work. It is necessary to strongly encourage the broad science and technology workers to be brave in their investigations and energetic in their creation.

We live in a great age, economic construction depends on science and technology and science and technology are geared toward the basic policy of economic construction, so it is mandatory to accelerate construction of a socialism having Chinese characteristics. It is hoped that the great army of 320,000 scientists and technicians throughout the province will follow the same path as the broad worker-peasant masses, have a pioneering spirit, and welcome the bountiful harvest from the 1984 battlefront in science and technology.

11582
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ON APPLICABLE LAWS IN TECHNOLOGY TRANSFER

Taiyuan JISHU JINGJI YU GUANLI YANJIU [RESEARCH ON THE ECONOMICS AND MANAGEMENT OF TECHNOLOGY] in Chinese No 1, 31 Mar 84 pp 51-52

[Article by Guo Siyong [6753 1835 3057]: "On the Applicable Legal Provisions in Technology Transfer Agreements."]

[Text] At the present time, in China's cooperation with foreign economics and technology, technology transfer occupies a position of extreme importance. When importing advanced foreign technology, the usual procedure is first, to conclude and sign a technology transfer agreement (this is also sometimes called a technology permit agreement), which defines the rights and obligations of the parties. Technology transfer agreements indicate the specific conditions under which the technology supplying side operates, and permits the technology acquiring side to obtain patents on inventions, trademarks, and exclusive right to the use of the technology. These agreements deal with economic, technical and legal questions. The present trend is that close attention is being paid to the economic and technical questions, but far too little to the legal ones, even to the point of neglecting them. For this reason, diligent research on the legal provisions of technology transfer agreements, as well as the dissemination of knowledge concerning them, have become matters of the utmost urgency.

Parties who enter into technology transfer agreements with foreign nationals, usually businesses and industrial enterprises of different nations, must deal with the laws of two or more nations. When there exist a set of questions which concern whether laws are in conflict or applicable, the issue gets extremely complex, for China has various ways and means of importing technology. There are ventures which combine joint capital and management; there are those which combine cooperative management and cooperative production; there are those which combine with supplementary trade; there are those which combine foreign auxiliary components; and there are those which pursue their own independent imported technology items, no matter what their form. The legal provisions of technology transfer agreements have their own special characteristics, and among these are such legally strong provisions as restrictive clauses, provisions on applicable laws, arbitration provisions, force majeure clauses, etc. As space is limited, this essay will deal only with opinions which differ in theory; there are provisions on applicable laws which conflict in practice. There will be some discussion, which will deal with China's reality, and I will offer some views of my own to provide a reference.

The provisions on applicable laws are also called the provisions on selected laws. They point out to the parties in an agreement what should be the applicable provisions when a dispute arises between the two sides. In other words, which nation's laws will determine the rights and obligations should there be a dispute. The provisions also define the limits of the parties' responsibilities, for example, by stipulating that in an agreement such-and-such a law is the applicable law.

As mentioned earlier, technology transfer agreements are relevant to a great many national laws. Therefore, when it comes to dealing with this matter abroad, it is necessary to have a comprehensive understanding of the theory and legislation involved. For it is only by collecting exhaustive data and comprehensively analyzing it that we can come up with the correct policy. At present, the majority of the world's nations include technological transfer agreements in international economic trade contracts, and all of these advocate the idea of sovereignty of the parties. They point out that according to the agreement the parties will jointly select which national laws are to determine their respective rights and responsibilities. Along with the development of capitalism, the idea of sovereignty of the state as a theory has received the close attention of scholars in the West. In legislative and judicial practice, it has also been accepted in quite a few countries, e.g., Italy, Spain, Japan and others have, in their national legislatures, expressly stipulated that a contract's applicable laws be chosen by both parties. In addition, as in England, France, etc., judicial practice has formally affirmed this principle by means of legal precedent. Even more nations have adopted this principle in this century. The Soviet Union and Eastern European nations have all basically accepted it in theory and practice.

Is the idea of the parties' sovereignty something that should be limited? There are differing theories on this. The theory that would limit the idea of sovereignty holds that the parties should select those of their nations' laws which are relevant to the contract, for example laws which conclude the contract, laws which implement it, etc. At the same time, the ideas expressed in the laws selected by the parties should be right and out of goodwill. Moreover, they cannot run counter to a nation's public policy, otherwise the organizations concerned can negate what they have selected. At present, the majority of nations, including among them the Soviet Union and Eastern European nations, are tending to this view. The idea of unlimited sovereignty in theory holds that contractual freedom is absolute, e.g., in England, judicial practice and some scholars hold that parties may arbitrarily select certain national laws and not accept limitations. In practice, absolute contractual freedom is an impossibility; even in England, there have been some decrees which have taken a stand opposing contractual freedom, and have imposed limitations. For this reason, at the present time the majority of nations pursue an idea of sovereignty that is a "limited idea of sovereignty."

The applicable legal provisions are of the utmost importance, and are key problems in the conclusion of technology transfer agreements. As for those matters of general concern regarding foreign commerce, there are points on importation which have been in negotiation for several years without reaching

agreement. An important reason for this is that each side sticks to its own position on applicable legal provisions, even though current agreements provide that when a dispute occurs between the two sides there normally will be amicable discussions to seek a solution. If amicable discussions do not achieve a reconciliation, then the matter goes to arbitration for solution. But this by no means absolutely eliminates the possibility of litigation as a solution, because if the two sides do not conclude the arbitration procedures, then a suit can be brought by the legislative body of whichever side has jurisdiction. No matter what type of channel is gone through, all will to a different degree involve questions of applicable laws. Therefore, in practice it is necessary to pay sufficient attention to this provision.

Such being the case, what would be an appropriate solution regarding legally applicable provisions in technology transfer agreements? The legal questions involved in these agreements are fairly complex. Since they are not the same as contracts in China which are carried out with capital management or labor management, contracts which relate to the joint exploration and development of natural resources should of course be fulfilled in accordance with our national laws. Specifically, the law promulgated on 20 Sep 83 which is titled, "Regulations for Implementing Chinese and Foreign Capital-Managed Enterprises." Article 15 of that law states clearly that, "in concluding contracts for jointly-operated enterprises, rendering service, interpreting, implementing and resolving any disputes which arise, all should be according to Chinese law." Also, technology transfer agreements are not the same as ordinary international commodity transaction contracts or transport contracts. These contracts' legal applicability can generally be referred to widely accepted, reasonable, international conventions for solution. In light of the special characteristics of technology transfer agreements, we recognize that, regarding questions of legal applicability, we can draw upon the experience of the great majority of nations that have opted for the limited idea of sovereignty. This idea stipulated that the parties to the agreement will confer and agree on selecting which national laws are closely related to the contract, namely the laws of the nation where the technology is to be implemented. At the same time, the laws selected cannot run counter to China's fundamental legal standards or China's national or societal interests. To be specific, China can agree to the parties' selecting which laws are applicable to an agreement, but there should be definite limitations. First, the laws selected must be those which are actually and closely related to the agreement; and those laws which so related principally should indicate the methods of concluding and carrying out the agreement. Looking at this from the standpoint of technology transfer agreements in particular, if these methods suit the technology in practice, then the methods of implementation will be suitable. Because after a country has imported foreign technology, and used that technology to advance production, through the production process there will be improvements in the technology--a whole series of implementation activities, all having the most real and closest immediate connection to the laws on implementation. It is only by having laws which are applicable in practice that the agreements can receive the most conscientious implementation, and can we ensure that the technology will receive the fullest implementation. Second, agreements must be founded in equitable, mutual benefits to both parties, with non-discriminatory

consultations: one cannot force anything on the other. This will prevent some developed nations from monopolizing enterprises, with the strong insulting the weak, and forcing the other side to submit to inequitable practices. Third, apply the "system for the preservation of public policy." Then if the laws chosen as applicable run counter to the public interest, applicability will not be granted. The system for the preservation of public policy mandates that China's legal provisions may be compatible with the laws of other nations, but if those foreign laws run counter to the interests of this country, applicability will not be granted. The nations of the world have all made this principle an important provision of their national legislation, and China has also affirmed this principle both in legislation and in practice.

When we are engaged in negotiations with foreign businesses, it should be in accordance with applicability of laws as discussed above. It should take as a principle that the national laws chosen be those which are actually and closely related. It especially should stress the principle that technology transfer agreements should be applicable to the laws on technology implementation, and as far as possible argue strongly on just grounds, that the agreements be applicable to the laws in practice, namely to China's laws, because in general all the technology will be implemented in China. If both sides hold to their positions on the legally applicable provisions, then they might choose a more flexible course of action, that is, not settling these provisions but just determining the provisions for arbitration.

In making a determination on arbitration provisions, the question of legal applicability may only be touched upon, in order to avoid disagreements. This is definitely the sensible way. On the contrary, there should be found an appropriate method of solution. Taking the long view, there are at present international conventions and international regulations which are concerned with arbitration in international commerce. Some nations have permanent arbitration bodies which in their arbitration sequence have rules concerning questions of legal applicability. Some of these are detailed, some sketchy, some are still unwritten. Among these rules are the 1976 United Nations Conference on International Trade Law Arbitration Rules, which are reasonable and definitely representative. Article 33, Section 1 of the Rules stipulates that "Courts of arbitration should apply the entities which all parties assign as applicable to the matter; when not all parties have assigned applicable laws, the court of arbitration should apply the legal stipulations of the regulations on international disputes which it regards as applicable." When we are concluding arbitration provisions, if the other side insists that there must be clear-cut questions of legal applicability, we can draw upon the appropriate lessons of experience.

In short, China is in the process of expanding and opening up economic and technical cooperation with various nations. The importation of items of technology is increasing daily. In order to fulfill our needs, proceed from China's realities, draw upon the experience of foreign nations and benefit economically, it has become a mission of the most pressing urgency for us to formulate a set of technology laws and regulations that are characteristically Chinese but also conform to the socialist spirit of the New International Economic Order.

NATIONAL DEVELOPMENTS

NATION'S SCIENCE SYSTEM REFORM CREATES 'GOOD RESULTS'

Beijing GUANGMING RIBAO in Chinese 24 Jan 84 p 1

/Article by the Science and Technology Group of the State Commission for Restructuring the Economic System: "China's Reform of Science and Technology System Creates Better Economic Results"/

/Text/ Inspired and motivated by the rural reform, many scientific and technological /S&T/ departments in China have carried out several exploratory reforms in the past few years. These reforms have been carried out in view of certain weaknesses in the current system and have focused on two major subjects promoting the integration of S&T and production, and eliminating the practice of "eating from the same big pot" to stimulate the enthusiasm for S&T workers. These reforms have created better economic results for society.

Create Multifarious Ways to Integrate S&T and the Economy

In the past few years, especially since the CPC Central Committee formulated new principles for S&T work and since Premier Zhao Ziyang delivered in 1982 an important speech at a national S&T award meeting on behalf of the CPC Central Committee and the State Council, many departments, localities and units have considered ways to gear S&T to the economy and integrate S&T with the economy as the primary task of their reforms. They have created many good examples for combining S&T and the economy, such as the integrated system of scientific research and production established in Dalian City; the integrated system of teaching, scientific research and production jointly established by institutions of higher education, such as the Huadong Institute of Chemical Industry, and several industrial cities, bureaus, counties, companies and enterprises; the "coordinated process" of scientific research, design production and service practiced in large and medium cities such as Shanghai and Changzhou; and the "technological cooperation" carried out by the Sichuan Carbon Black Research and Design Institute under the Ministry of Chemical Industry and the Silicate Chemistry Technology Institute and the Lanzhou Chemical Physics Institute under the Chinese Academy of Sciences with their counterpart industries and enterprises. A common point of these examples is that they closely combine scientific research with production, research with demand, and S&T with the economy. They connect all links between scientific research and production, thereby reducing the time needed for scientific research and production and speeding up the industrialization and commercialization process of scientific achievements. The

Dalian Textile Printing and Dyeing Complex is an integrated system of scientific research and production jointly established by 4 research institutes, 2 universities and 16 textile enterprises. Coordinating related academic departments and linking scientific research with production have created strong scientific research and production capacities and substantially accelerated the development of new products. It takes only 6 months to a year to fulfill a task which used to take 2 years. As of today, this complex has undertaken 46 major scientific research projects and developed more than 250 new varieties and designs. In 1983 it created over 100 million yuan of output value and delivered to the state 19.25 million yuan in the form of taxes and profits.

Scientific Research Units and Universities Carry Out Long-Term and Comprehensive S&T Cooperation With Industrial Cities and Departments

On the basis of conducting single-item and short-term S&T cooperation with plants and enterprises in the past, some scientific research units and universities have further catered to the needs of society and economic construction in the past few years by carrying out long-term and comprehensive S&T cooperation with provinces, municipalities and departments. For example, Zhejiang University, Qinghua University, Xi'an Jiaotong University, Tianjin University and Nankai University have carried out S&T cooperation with Tianjin Municipality on different occasions. Such cooperation has played an important role in accelerating economic construction in Tianjin Municipality. It has also substantitally promoted the scientific research and teaching work of these universities. Institutions of higher education and scientific research units, including the Huadong Institute of Chemical Industry, the Nanjing Institute of Engineering, Nanjing University and the research institutes attached to the Ministry of Space Industry have enacted S&T cooperation with Changzhou City. The Huazhong Institute of Engineering and the Huadong Institute of Textile Industry have cooperated with Shashi City. Institutions of higher education including Shanghai Jiaotong University have cooperated with the Xinjiang Uygur Autonomous Region. All this has created marked results. The Chinese Academy of Sciences and its branch academies have also established long-term and comprehensive S&T cooperative relations with related provinces and municipalities. The Changchun Branch Academy has helped Siping City formulate plans for S&T, economic and industrial development. It has transferred S&T achievements to Siping on favorable conditions. It has helped Siping train technicians and solve major technological problems. It has sent S&T consultative groups to Siping to conduct S&T consultation and transmit the latest domestic and foreign S&T information in a timely manner. At an S&T cooperation and exchange meeting in November 1982, Siping City established long-term cooperative relations with 22 universities and 35 scientific research units and transferred 212 items of S&T achievements. It is estimated that after these items are used in production, they may produce 170 million yuan of output value and 20 million yuan of taxes and profits for the state each year.

Open Up Technology Markets and Establish Technological Service Companies

Along with the development of a commodity economy and the introduction of market regulation in economic management work, S&T achievements have also appeared on the unified socialist market in the form of commodities, creating a new market--a

technology market. In the past few years, many provinces and municipalities have convened S&T achievement trade fairs and S&T cooperation and exchange meetings.

With the appearance of a technology market, many localities have established technological service centers or companies. For example, the Shenyang City Technological Service Company, founded in 1980, has actively organized the promotion of S&T achievements and development of new products, coordinated with all S&T departments in solving major technological problems and adopted various means to link scientific research with production. In the past 3 years, over 44,000 persons have participated in technological service activities; 4,357 contracts for S&T achievement transfer and technological service have been signed through coordination and management of such service companies; and the total amount of transactions have reached 73.34 million yuan. So far, 1,740 contracts have been fulfilled, creating great economic results for society.

Change the Appropriation Method and Enact a Fee Contract System

To overcome the negative results caused by the fact that all research work depends solely on state appropriations, some units have experimented with various ways to change the appropriation method. Jiangxi and Zhejiang provinces have tried charging fees for the use of S&T funds. Xiangtan City has tried issuing S&T loans. Departments in charge of S&T in Shandong and Jiangsu provinces have tried signing paid contracts with some technology development and research units under their jurisdiction. All of this has shown initial results. Wuxi and Shashi cities have also tried to establish an S&T fund system. Practice proves that establishing such a system is favorable for concentrated utilization of S&T funds. Using the "snowball" effect, it is possible to gradually increase S&T funds and give more financial support to S&T work. The science fund set up by the Chinese Academy of Sciences is mainly used to support significant fundamental studies and exploratory practical studies. This fund has been welcomed by all S&T workers inside and outside the academy ever since its introduction. It has achieved good results.

12302
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PROBLEMS IN TECHNOLOGY TRANSFER DISCUSSED

Taiyuan JISHU JINGJI YU GUANLI YANJIU /RESEARCH ON THE ECONOMICS AND MANAGEMENT OF TECHNOLOGY/ in Chinese No 4, 31 Dec 83 pp 59-60

/Article by Cheng Zaide /4453 0961 1795/: "Problems in Technology Transfer Await a Solution"/

/Text/ Along with the rapid development of science and technology /S&T/ and market competition, technology as a commodity export is increasing daily. During the process of industrialization, many developing countries have imported, in different ways, a large amount of advanced technology from developed countries, which has accelerated their economic development and created satisfactory results.

China has a weak economic foundation, backward technology and a shortage of funds and qualified personnel. To carry out the four modernizations under these conditions, we must attach great importance to drawing support from international technological forces, absorb the advanced S&T achievements of developed countries and avoid starting from scratch and taking roundabout courses to gain time and narrow the S&T gaps between China and developed countries. Since the 3d Plenary Session of the 11th CPC Central Committee, China has implemented an opendoor economic policy, established technological cooperation relations with many countries and imported a great deal of new technology on the prerequisite of self-reliance and fully tapping technological potential. This has accelerated the development of economic construction, promoted the study of related sciences, helped improve the structure of technological organizations and created marked economic results in China. However, due to a lack of experience in technology transfer, some departments and enterprises have failed to integrate technology transfer with technology popularization and technical transformation and blindly and repeatedly imported unnecessary technology. They have spent time and money but they have not generated the expected results. This is a profound lesson. How do we rely on domestic S&T forces, protect their scientific research and achievements and bring their role into active play? These are problems awaiting urgent and conscientious study and solutions in technology transfer.

1. Technology transfer should be closely integrated with the technical transformation of departments and industries. Technology transfer involves many fields and can be done in many ways. Setting a clear direction for technology transfer is very important to selecting technologies to be imported, formulating plans for technology imports and promoting technology transfer. A leading comrade

of the CPC Central Committee recently pointed out: "Technology imports should be closely integrated with technical transformation of industries. Projects for technology transfer must not be judged on their own merits; nor should they be separated from technical transformation plans." This has offered a clear orientation for technology import. In accordance with state policies on technology and equipment, we should first study the weaknesses of our own departments and industries to discover where we lag behind in comparison to foreign countries. On the basis of thorough study and examination, we should establish priorities and carry out technology imports in a systematic and planned manner so as to achieve the goal of hastening the development of the whole industry and region.

To closely integrate technology transfer and technical transformation, we should pay attention to the following two issues. First, we should adopt an overall point of view, carry out plans designed for the whole industry, strengthen national coordination and do everything in accordance with the principle that imported technology should be shared by all to benefit the whole country. We should avoid redundance and waste. Second, we should do a good job in preparation work, ensuring the funds, auxiliary projects, raw materials, electricity and fuel needed for imported technologies. We should also do a good job in the "two coordinations." One is the coordination of the study of major S&T problems, the import of technology, the development of technology and technical transformation. The other is the coordination of experts and technicians in the field of scientific research, design, production, information, economics and management.

2. Efforts should be made to do a good job in the assimilation and improvement of imported technology. Technology is not imported just to be used in production. It is imported to be studied and developed. Our ultimate purpose in importing technology is to develop a socialist economy and raise our S&T level. Therefore, whenever we import an item of technology, we must organize S&T forces in all fields in a planned manner to study, analyze, assimilate, improve and develop it to raise the domestic standards of scientific research and designing and increase our ability to develop the same or similar kind of technology at home.

Selecting proper units to import technology is also very important for assimilating imported technology. In principle, priority in technology import should be given to those enterprises and departments which have a high level of production techniques, a sound economic management foundation, strong technological forces and research capability and conditions to deal with foreign countries. The government and departments in charge should give these enterprises preferential treatment in allocating funds, importing equipment and transferring S&T personnel. They should also give them greater decisionmaking power in research and development to promote assimilation of imported technology.

3. Attention should be paid to software imports. Software imports generally concern the import of patent manuals, drawing information, technical standards, technical guides and computer programs for designing, technology, manufacturing, installation, debugging, testing, repairing and management. It also refers to the employment of foreign experts and technological training programs. At present, some comrades confuse technology transfer with equipment import and pay attention to importing equipment. They contend that since equipment is

hardware, importing advanced equipment can speed up changes in technology and production and improve economic results. They ignore the import of patents, designs and other software. Due to this one-sided understanding, the percentage of software in total imports has always been very small. Of course, in order to meet urgent needs and save time, importing some equipment which cannot be manufactured or whose quality cannot be guaranteed at home is extremely important. However, the percentage of such imports should not be too large. We should understand that unlimited import of equipment will result in our dependence on foreign technology, undermine the development of our industry and technology, directly affect our advance toward self-reliance and run counter to the basic objective of technology imports.

4. The organizational management of technology imports should be reformed and perfected. This is a key to the success of technology imports. Practice proves that we can avoid blindness and overlapping in technology imports and achieve greater economic results only if we subject our plans to repeated comprehensive balance and thorough discussion and examination, include them in the unified state plan and go through the proper procedure of examination and approval. To do so, we must do a good job in the preparation work of technology transfer. We should completely correct the practice of ignoring the role of experts and specialists and following the decision of only a few leaders or one person. After technology is imported, we should organize people in the field of scientific research, designing, production and business management to assimilate the imported technology to achieve the result of changing the technological standards of enterprises.

5. An information system of technology transfer should be established. All countries attach great importance to the exchange of technological information, and they show great concern for international technological needs, development of advanced technology, economic results of technology transfer and newly-discovered problems. At present, our technological information exchange system is weak. We do not have easy access to information. The amount of information we receive is small. All this has directly affected the understanding of international market conditions and the selection of technologies to be imported. It also contributes to the causes of blindness in technology imports.

To change this situation, we should establish special information organs for technology transfer at national and local levels as soon as possible. These organs then will take responsibility for gathering information on the production and technological capacities planned and needed for national and local development; understand technical projects under construction, their material conditions and their need for technological service; and keep informed of investments, negotiations, international market prices, technology selection, conditions and S&T knowledge related to technology transfer.

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IMPROVEMENT OF S&T INFORMATION WORK URGED

Beijing GUANGMING RIBAO in Chinese 10 Feb 84 p 2

/Article by Yang Jun /2799 3182/, vice chairman of the State Science and Technology Commission: "Scientific and Technological Information Work Should Serve Economic Construction More Effectively"/

/Text/ How can scientific and technological /S&T/ information work serve economic construction more effectively? This is an important question that the people are extremely concerned about. The glorious task of the S&T information work is to provide timely, accutate and reliable S&T information for economic construction to accelerate its development. The CPC Central Committee and the State Council have emphasized that S&T is a productive force and should be considered a priority in the strategy of China's economic construction. They have also set forth the basic principle that "economic construction must rely on S&T and that S&T must serve economic construction." Being an important component of S&T work, S&T information work must resolutely implement this principle.

Strengthen the Development and Utilization of Information on Production Techniques

At present, the most important and urgent matter is to strengthen the study, development and utilization of information on production techniques. Many laboratory achievements have not been quickly transferred into real products. Many imported technologies have not been assimilated in a timely manner. Renovation is out of the question. At the same time, a series of S&T problems in key construction projects of the national economy and technical transformation of traditional industries are waiting to be studied and solved. Therefore, we should provide timely and accurate information on the newest S&T developments and achivements at home and abroad. We should particularly strengthen the development of information on production techniques and work as a "bridge" to promote the close integration of production and research, the transfer of production techniques from laboratory achievements into real products and the study and solution of problems concerning production techniques. We should concentrate S&T information forces to create substantial development and improvement in the information work of production techniques in 2 to 3 years.

We should strengthen information work in plants, mines and enterprises at the grassroots level and in rural areas. This is an important link. Large and medium-sized plants, mines and enterprises may establish special organs or hire

fulltime intelligence personnel. Small enterprises should at least have one parttime intelligence workers. Parttime intelligence personnel should be trained in the vast rural areas to suit the needs of grassroots units and rural areas for S&T information.

We should establish and perfect various special information networks and stations. This is a characteristic of China's S&T information system. Great achievements have been made in the past. Efforts should be made to bring about further development and improvement, do a more thorough and painstaking job and render better service for industrial and agricultural production. Some networks and stations have adopted a contract service system to improve service quality. This practice should be popularized.

We should strengthen the gathering and exchange of information on domestic production techniques. The S&T information centers of some departments and localities have conscientiously compiled and published such publications as reference materials of applicable technology, brief introduction of production technology research subjects and brief news on production techniques. This is a very good practice. Organizing technological exchange of mass-produced and widely-used products is also a good practice. Inferior products and backward techniques may be given priority in providing information and technological consultation.

We should strengthen work regarding information on foreign production techniques. We should open up channels and strengthen management and reporting work. When we import technology, we receive a large amount of information on production techniques which should be fully assimilated and utilized. This is a problem awaiting an immediate solution.

We should expand the scope of S&T information service by including information on the economics of technology, markets, management science, negotiations of technology transfer and promotion and utilization of production techniques.

Strengthen the Work Regarding Information on New Technology and Industry

The development and widespread utilization of new technology concerning microelectronics, communications, biotechnology, new materials, new energy resources, space industry, oceanography and nuclear power will bring about great changes in production and the daily life of society. We must follow their trend of development in terms of overall economic and social development. While making decisions and development plans, we should consider the basic structure, market and possible economic results of these technologies.

We should strengthen the analysis and study of foreign forecasts on S&T, the economy and social changes. We should pay attention to comparing different views of different schools and analyzing the trend of development of new technology and industry in foreign countries and their experiences so as to provide information and study reports for our country to formulate strategic policies and long-term plans and import technology. We should pay attention to information about new technology and the analysis and study of sample products used in different fields. We should establish various information networks for

new technology. First of all, we should establish networks for microcomputers and their utilization to concentrate and exchange information in this regard. Special attention should be paid to acquiring detailed information on the production, research, utilization, import and technical forces of microcomputers and studying and analyzing successful experiences and existing problems to accelerate the development of this new technology. Continous efforts should be made to study information on basic research and closely pay attention to research projects that may cause major breakthroughs in production techniques.

We should unfold information work around long-term development strategies for society, the economy and S&T. S&T information workers should actively participate in the nationwide study "China in the Year 2000," formulation of long-term S&T plans, principles and policies and the study of a comprehensive strategy for developing the economy, S&T and society. In view of major problems in their own departments and localities, these workers should systematically carry out strategic, comprehensive and long-term information investigation, analysis and study to provide information and study reports for leaders to make policy decisions. Conditions should be created to help them better understand the development of the country and acquire more knowledge of economics and S&T.

We should establish a national central computer system, which has been classified as a key state project. We should organize all S&T forces to make concerted efforts to fulfill this goal. At the same time, we should start building several regional and special department computer systems and gradually establish modernized information networks first in major cities and industrial centers.

For S&T information work to effectively serve economic construciton, we must train and cultivate large numbers of S&T cadres who have both ability and political integrity. We should strengthen the management and utilization of S&T contingents and ensure that S&T information work and workers genuinely play the role of vanguards, informers and advisers. We must encourage and support S&T information workers to quickly understand and introduce new achievements of the world in modern S&T, to be realistic in reflecting problems in objective reality and to feel free in expressing their opinions and making suggestions for various fields. It is self-evident that they will do great harm if they are not eager to make progress or if they close their eyes and stop up their ears. Therefore, we should encourage them to be enthusiastic about yearly, monthly or weekly inquiries and follow up on the newest information on S&T and the latest global trends so as to bring their role into full play in the four modernizations.

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GUANGMING RIBAO ON TECHNOLOGY, ROLE OF EDUCATION

OW091319 Beijing XINHUA in English 1143 GMT 9 Apr 84

[Text] Beijing, 9 Apr (XINHUA)--Some Chinese experts have suggested that China set up its own "silicon valley" to promote development of such new industries as microelectronics and biological engineering.

Today's GUANGMING DAILY sums up these suggestions in an article "How China's Education Should Meet the Challenge of the New Technological Revolution" by the Central Educational Science Research Institute.

A Chinese "silicon valley" they said, could concentrate scientific institutes and production of sophisticated technology like "silicon valley" in California and the new industrial area in the suburbs of Boston in the United States.

China's universities should gear their curricula to the frontier sciences and other new branches, giving students a broader and multiple disciplinary knowledge, they said.

They also suggested that the universities serve industrial departments and become educating and consulting centers for the whole society.

Professor Ye Nanxun of Nanjing University called for early establishment of a computer college to train postgraduates and undergraduates while also offering special courses and short-term training courses.

Vice-Minister of Electronics Industry Wei Mingyi said microelectronics is a new processing industry involving knowledge of over 70 specialities and suggested that the government emphasize investment in education to train more microelectronics specialists.

Wang Shouwu of the Chinese Academy of Sciences, said the "information industry" is knowledge intensive and training personnel is more important than importing equipment.

Some division members of the academy pointed out the urgent need to refresh the knowledge of Chinese scientists and university faculty members. Out-of-date knowledge can be used to train students to get high grades in examinations but it will not equip them to do the scientific research needed today, they said.

In order not to lose the opportunity of joining the new technological revolution, biologist Cao Tianqin said, it is essential to train young scientists and invest more in education for the future of China.

The technological revolution will bring about a decrease in the number of manufacturing workers and an increase in service workers, one scientist said. Departments of education should be aware of the new demands for regular, spare-time and workers' colleges.

Some of Zhejiang University professors advocated speeding up vocational education to raise the technical standards of Chinese workers.

They proposed that universities not only train their regular students but also undertake the task of a "second student body" to train technicians and workers.

CSO: 4010/90

SCIENCE, TECHNOLOGY MANAGEMENT REFORMS VIEWED

OW161926 Beijing XINHUA in English 1640 GMT 16 May 84

[Text] Zhouxian, 16 May (XINHUA)--Research institutes engaged in technology development and popularization may soon have to work efficiently to raise money instead of relying on the allocations from the state as they have been doing.

Zhao Dongwan, head of the office of the State Council's Commission on Science and Technology, said here today that it was imperative to reform the science and technology management system which was lagging behind the country's economic and social advances in both rural and urban areas.

Zhao was addressing the opening ceremony of national forum on the reform of science and technology management, held in Zhouxian, Hebei Province.

Zhao, who is also vice-minister of the State Science and Technology Commission, noted that research units are basically distributed in accordance with administrative divisions. They are funded by their higher authorities and any staff changes have to be approved by the authorities. Therefore, there has been little inter-reaction among research institutes under different ministries and localities, resulting in duplication of efforts.

The central government has decided to reform the science and technology management system and has pointed out the direction for the reform, according to Vice-Minister Zhao. The general principle is to combine research with production as far as possible, and bring the initiative of scientific and technical workers into full play.

Zhao also outlined his own tentative ideas about the reform, which are as follows:

--popularizing the contract system in research institutes engaged in technology development and popularization, to allow them to assume sole responsibility for their profits and losses. This could be put into effect nationwide within three to five years.

--experimenting with setting up funds for research institutes engaged in theoretical research and some institutes engaged in research in applied sciences. Such institutes would be granted special funds only if they prove the most successful among several units engaged in the same fields of research.

--continuing to establish various inter-trade, inter-speciality, inter-ministerial and inter-regional cooperation in undertaking major research projects, and combining research with production and teaching. Some research projects may be undertaken with international cooperation.

--readjusting the distribution of research units in the countryside according to the new rural situation and agricultural zoning, instead of distributing the units according to administrative divisions such as counties and prefectures. This will help reduce duplication of research work in places with similar natural conditions.

--making experimental reforms in selected cities and departments--citywide experiments are to be carried out first this year in four cities: Dalian, Chongqing, Changzhou and Xiangfan.

Zhao also said that in research institutes chosen as experimental units, research projects should be undertaken under the contract system and scientists and engineers should be allowed to freely organize study groups each responsible for one of the projects. Their rewards should be linked to their professional skills and contributions.

Experiments to reform science and technology management began as early as several years ago. According to statistics, 87 research institutes in 19 provinces and municipalities have assumed sole responsibility for their profits and losses and are financially self-sufficient. More research units have applied to be treated as experimental units.

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IMPLEMENT REFORM IN SCIENTIFIC RESEARCH UNITS

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 1, 1984
pp 30-34

[Article by Xu Qianwei [6079 0467 0251] scientific committee member of Tianjin: "A Discussion on Reforming the Scientific Research System"]

[Text] In order to realize the strategic objectives formulated by the Twelveth Party Congress, to gear science and technology work to the economy, to serve the four modernizations, and to create a new situation for scientific and technological work, reform is necessary. In recent years, some scientific research organizations in Tianjin improved research management and actively promoted economic management methods. Some reform was experimented in the aspects of research subject management, technical personnel utilization and the research system. These preliminary reforms eloquently indicate that there is vitality in scientific and technological work only with reform. Through reform, scientific research results became more abundant year after year. The economic results were also greater year after year.

I. Urgency of Reforming Scientific Research Units

There are three shortcomings in the present scientific research management system: First the problem of how to gear scientific research to the economy and serve economic development has not been resolved. Second, research units do not have enough autonomy. The problem of "all eating from the same big pot" is especially significant. Third, the enthusiasm of scientific and technical personnel has not yet mobilized, and their role has not been fully developed. In order to solve these three basic problems, scientific research units must be reformed.

A. Reform of Scientific Research Units Is Necessary for the Coordinated Development of Science and Technology, Economy and Society.

In the past, the scientific research organizations in Tianjin have contributed significantly to economic development. According to statistics on 20 research results by 12 research institutes, the cumulative annual output value after those accomplishments were promoted and applied is worth 22.18 million yuan. The annual revenue created is over 5 million yuan. However, generally speaking, current research work still cannot satisfy the urgent need of economic development. Based on a preliminary adjustment analysis on all municipal research

organizations in the four areas of tasks, leadership, research team and research results, only 28.2 percent are good, 50.4 percent medium and 21.4 percent poor. This is far from the requirement of the scientific and technological development policy specified by the State Council and Party Central Committee. Some of the institutes still cannot perform scientific research, 5 years after their founding, and are unable to produce results. Some institutes on the average require 25 people to accomplish a project in a year. Some institutes were not established rationally. The direction and duty are repeated. Therefore, to meet the needs of economic and social development, research units must be reformed.

The preliminary practice of research unit reform shows that vitality will appear immediately after a slight reform. For example, the institute of textile industry in recent years adopted methods such as research results with compensation and expanded pilot plant testing, to allow some research results to be applied in a relatively short period of time. This institute successfully developed a new vortex spinning technology. Production efficiency is 3-5 times higher than that of the conventional circular spindle spinning. The "vortex yarn" produced was supplied to a knitting plant for a new fabric product. The annual revenue created is approximately 2.1 million yuan and is exported to eight countries. The annual additional income of the institute was over 2 million yuan. It was not only sufficient to compensate for the research costs but also increased the income of the research personnel. This example demonstrates that reform will benefit research work, benefit economic development, and also create social benefits. It coincides with the law of coordinated development in science and technology, economy and society. Thus, it is capable of solving the problem that some areas in production cannot satisfy the development of productivity and some aspects of upper level construction cannot satisfy the development of the economic basis.

B. Reform of Research Units Is Necessary to Develop Scientific Research Organizations.

The development of scientific research organizations in Tianjin a while ago was successful. The arrangement of special fields in scientific research organizations was preliminarily completed. The role of the research system was developed day by day. However, at present the work of research organizations does not meet the needs of economic development in many areas, such as unclear duties, undefined authorities, work disputes, poor efficiency, overstaffing and "eating from the same big pot." It is essentially a problem of the research management system; therefore, the scientific research system must be reformed. Reform means to get rid of the old to make way for the new, which means to reform the traditional management style and custom. This is fundamental development work, necessary to develop the research organization itself.

Scientific research reform involves many problems, such as the organizational setup, establishment of a technical management system, democratic management, economic management and management of results. However, the key is to solve the problem of the lack of autonomy of the research institute and that of "eating from the same big pot." Some of the research units in Tianjin practiced

various technical responsibility systems. It is a fundamental management system combining responsibility, authority and benefit, which resolved a core problem in the management of the research organization work. It is an effective method to improve the efficiency of scientific research.

C. Reform of Research Units Is Necessary To Effectively Develop the Role of Scientific and Technical Personnel.

The direct objective of research organization reform is to thoroughly liberate the productivity of the intellectuals, and to mobilize the enthusiasm and creativity of the scientific and technical personnel who are the main body of the vast staff members. It will ensure that "accomplishments will be made and talents will emerge" to better serve the national economy.

At the end of last year and the beginning of this year, we used a selective random sampling method to survey some scientific and technical personnel and scientific and technical management personnel in central research units in Tianjin and three city research units (one each in machinery, light industry and textile). There were 6, 121 and 137 persons at senior, middle and junior technical levels respectively, totaling 335 people. In scientific research, 106 could satisfactorily accomplish the tasks, accounting for 29.85 percent; 217 people could generally accomplish their duties, accounting for 61.12 percent; 32 could not finish their assignments, accounting for 9.03 percent; 30 were either not used properly or mismatched in profession. Furthermore, most of them were middle level technical personnel. In order to change the third situation around completely to enable these scientific and technical personnel to fully develop their role, and to transform the second situation into the first to allow these technical personnel in the maximum proportion to be fully functional, it is necessary to reform the management of the scientific research team in organizations.

II. Diversity of Methods to Reform Scientific Research Units

The reform of scientific research units in Tianjin in recent years began by feeling and finding out from the actual situation under the current system. Although most units belong to the category of "small reform," several institutes made larger steps towards reform. However, their initial practice shows that the ways to reform scientific research units are diversified.

A. Internal Management--Vertical Reform.

(1) Contract System. More and more research units are using the contract system to strengthen the management of scientific research. In addition to the distribution of research assignments to the research institutes by the scientific committee of Tianjin and the signing of specific contracts for compensation and partial reimbursement, many research units use the contract system to undertake external research subjects and to provide technical services, as well as to arrange internal research topics and assign the work. Institute 1664, which is involved in the development of new electronic material, began to try out the

contract system in 1979. In addition to practicing a contract system centered around the "five fixes" (fixed duty, fixed personnel, fixed funding, fixed facility and fixed reward and punishment) (54 contracts were signed between 1980-1981), contracts were signed with the cafeteria, drivers and logistic departments of farms. Consequently, the progress of research and other work was greatly promoted. For example, the contract system significantly improved the quality of 331 engineering solar cell substrate fabricated. It was specified as a trustworthy product. The crystallization rate was improved from 35-40 percent to 70-80 percent.

(2) Responsibility System. In order to resolve the problem of "eating from the same big pot," some scientific research units practiced various forms of the responsibility system. For example, the institute of industrial automation instrumentation officially practiced a floating designer-in-charge responsibility system. The person in charge of the subject--the designer is totally responsible for the implementation of the subject. He can choose the talents needed within the domain of the institute to "form his own cabinet." The subject group thus created can better mobilize the enthusiasm of the technical personnel. There will be relatively less "internal loss" and contradiction to improve the efficiency of research. In the past, because "all eating from the same big pot," usually no one was willing to take the responsibility of chief designer. Due to the implementation of the responsibility system, responsibility, authority and benefits are linked together. Everyone vies to take the responsibility, which promotes the development of talents. Chief designers are not life time posts. If a research subject is completed successfully, one can continue to be the chief designer for the next one. If it does not work out well, then one will have to have an assistant. This institute also linked this responsibility system with rewards, promotion in technical position and fringe benefits.

(3) Subcontract System. This is a method to undertake scientific research tasks, which is different from the contract and responsibility systems. For example, the Academy of Science of Tianjin is supervising the survey team for the State Seismological Bureau, which has over 450 staff members to undertake research tasks on field monitoring of deformation of the earth's crust and to forecast earthquakes by topographic deformation in the areas of Beijing, Tianjin, Tangshan and the Northeast Region. The task standards and subsidy standards of the State Seismological Bureau were implemented. Each person was compensated for working in the field for one day by 1.5 yuan. Thus, it was common for no one to return to the team ahead of schedule after the field job was done. The purpose was to continuously receive the allowance, creating the problem of paying more for road maintenance, automobile, tools, field work and lodging. In May 1980, the team implemented a system of the "four fixes" (fixed duty, fixed quality standard, fixed cost and fixed personnel) and "two guarantees" (field allowance and completion time). For over 2 years, under the premise of ensuring the survey work, the survey duty has been completed on over 2,200 kilometers ahead of schedule, saving the costs and creating a fortune for the country by 1 million yuan.

(4) Technological Development Department. To meet the needs of economic construction and to create conditions to rapidly convert research results into direct productivity, some research units established a technological development department. The institute of welding technology established a technical service

department in 1981 to undertake the welding technical service work for all the trades and business in Tianjin, including major welding jobs for the imaging tube plant and the imported equipment in the petroleum textile plant. An "economic technological development" department was established by the technical personnel not involved in research projects in the 1446 Institute in June 1981 to perform research outside the research plan in order to directly serve economic development. For example, they conducted applied research on single crystal silicon. Through modification and measurements, not only the need in China was supplied but also over 4 tons were exported, creating more than 166,000 dollars in foreign exchange for China.

B. External Connection--Horizontal Reform

(1) Organize a Coordinated Process or a Joint System for "Research, Production, Sales and Utilization." For example, in the research and application of new pesticides, over a dozen units from five departments formed a coordinated process. There were research units, production units and sales and utilization units, starting from fundamental research to large area utilization by the production teams in villages. In recent years, 15 highly effective, low toxic pesticides have been developed; 13 of them are already in production. Currently, this coordinated process is developing toward the formation of a joint system.

(2) Organize An Interdisciplinary Multi-talented Special Subject Coordination Team. For example, the biomedical engineering coordinating team included trades such as chemical engineering, material synthesis, light plastic materials and biomedical equipment. Over 50 units from higher learning institutions, scientific research units, hospitals and plants participated. From the selection of material to artificial synthesis, from fabrication of artificial organs to clinical applications, a collaborating network was organized; 31 important accomplishments have been obtained in the 7 years since its existence.

(3) Establish Technological Development Centers. The problem of how technological development centers should be set up was explored in 1982 through the evaluation of the series provided by the Institute of Welding Technology to various trades. Research units such as the Institute of Paper-making and Knitting are attempting to establish development centers, testing centers, information centers and personnel training centers for new products, new techniques, new technologies and new materials.

C. Technical Personnel Management--Comprehensive Reform.

(1) Bringing External Talent Into Research Units. In addition to getting the personnel through channels such as regular transfers and assigned college graduates, a method, such as advertising, to bring in external talent was adopted to strengthen the scientific and technological manpower at each research institute. Since 1981, with the approval of the city government, the Institute of Scientific and Technological Information of Tianjin publicly invited the application of scientific and technological information personnel above the middle level from people who were either employed or unemployed. Over 20 people

have already passed the examination in technical expertise and evaluation of foreign language, and were transferred to the information institute. As another example, experts were retained on a part time basis. The city institutes of laser technology and technical physics retained professors from higher learning institutions to lead the research work at both institutes. Consequently, the research standard was effectively improved. Although the institute of laser technology is a relatively new research unit, two research accomplishments have already received the national invention awards. By doing so, the "department ownership" and "unit ownership" were taken apart to a certain extent to allow the scientific and technical personnel to fully develop their role.

(2) Moving Talents Directionally in Research Units. Units such as the institute of textile industry and institute of industrial automation instrumentation adopted the method of "freely organizing a cabinet" in recent years to allow the personnel in the research unit to move on directionally so that talents can be fully utilized. The so-called "free cabinet organizing" system means that the scientific and technical personnel can organize their own project group based on the need of the research work, instead of following administrative orders as in the past to rigidly form a group. Thus, the enthusiasm of the technical personnel can be promoted so that they can be useful to the fullest extent possible. By doing so, the ones who are lazy and drifting aimlessly will not last. Moving the technical personnel in a certain direction in and our of a research unit will change the talent structure in the institute profoundly. We are working very hard on the gradual rationalization of the professional structure, intelligence structure, capability structure and age structure.

(3) Reform the Scientific and Technical Personnel Wage System. The institute of textile industry tried a floating wage system in 1983. They distributed total wages and bonuses based on 1982 levels among the employees using a floating wage plus bonus system. Those who worked hard got more. The diligent ones were rewarded and the lazy ones were penalized. According to the results of a public opinion survey, the leadership equally determined the floating wage levels. As of the end of June, 770 people increased their wages, accounting for 78.4 percent of the employees at the institute; 656 people increased wages by one level, accounting for 66.8 percent; 110 people increased their wages by two levels, accounting for 11.2 percent; 4 people increased their wages by three levels, accounting for 0.4 percent. One person had a decrease in wages (10 percent cut in salary), accounting for 0.1 percent. The evaluation is done quarterly at the institute. For personnel whose salaries are not subject to floatation, an appropriate reward is given based on performance. By doing so, the situation of heavy work load, heavy family burden and low salary encountered by middle age key technical staff members can be changed. The salaries of engineers can usually reach an equivalent level.

Through preliminary practice, we feel that reform must proceed from reality. It should begin with a summary of experience and consider the special features of different research institutes. It should not follow one model. If various responsibility systems are to be established to meet the special characteristics of some research work, the contract responsibility system used in industry and agriculture should not be followed, i.e., various models may be allowed in the same unit.

III. Synchronism Between Research System Reform and Other Related Work

Any reform will have to insist on the system principle. The four modernizations construction is a large system; scientific and technological work is part of the system. Research institutes are subsystems. The reform of research institutes must be restricted by the upper levels. Therefore, it is necessary to consider the coordination and linkage with the superior levels. In the meantime, other related work must proceed simultaneously with the reform. Only by doing so will reform of research units be carried out smoothly, and starting from the overall results to carry out comprehensive results.

A. Combine Reform With Reorganization. One of the tasks of scientific and technological work in 1983 as proposed by the State Scientific Committee is to reorganize scientific research organizations. Tianjin held a working meeting on the reorganization of scientific research units in January and asked that this task be completed within 1 to 2 years. Reform and reorganization complement each other. In a certain sense, reorganization is the foundation of reform and reform is the continuation of reorganization. Therefore, both reorganization and reform are required to develop research organizations. The major objectives of the reorganization and reform of research organizations should coincide: 1) The leadership should do a good job to gradually meet the requirements to be revolutionary, young, knowledgeable and professional. 2) The direction and mission should be clarified to solve the problems we are facing and to promote progress in production technology and to improve economic results. Technological development centers for various trades should be established. A chain or an entity consisting of scientific research, production and marketing should be organized. 3) The research team should be properly developed and effectively organize and utilize the technical staff to the fullest extent possible. A responsibility system should be gradually implemented. 4) A scientific research management system should be well established to practice scientific management. If the policy of adjustment, reform, reorganization and improvement can be comprehensively executed, reform and reorganization of research units can be successfully combined.

B. Reform of Scientific Research and the Economic System Should Be Considered At the Same Time.

In order to establish a research unit management system which agrees with our national conditions, research reform should be synchronous with a reform of the economic system in order to accomplish its function to collaboratively develop science and technology, the economy and society. On the other hand, any reform of research units will hardly move without reform of the economic system. For example, if the financial system is not reformed, a research institute will not function without some fiscal autonomy. As another example, the regulation that any scientific research result cannot be compensated and transferred externally should be changed. The research institutes, especially those that belong to corporations, should be given the authority to operate.

C. Catching up With Political Thought.

In scientific research reform, political ideology work is an indispensable link. It is an important assurance to overcome various resistance and to break away from the constraints of traditional concepts and customs. It ensures that

reform will proceed smoothly. It must be carried out simultaneously with scientific research reform. It is necessary to strengthen the construction of spiritual civilization and intensify morality education and ideology work. Presently, the political ideology work cannot meet the need of scientific research from form to content. The level of political ideology work should be improved through reform.

Following this path, the reform of research units may proceed positively and steadily. In addition, the spirit of investigatory study to find the truth must be emphasized during reform. The existing reform methods developed in recent years should be summarized seriously. We must pay special attention to reform in experimental units. The experience acquired in experimental units should be further expanded to promote the reform work.

12553
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ISSUES ON MANAGEMENT OF SCIENCE, TECHNOLOGY DISCUSSED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENTIOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 3, 12 Mar 84 pp 16-19

[Article by Hu Shilu [5170 0013 4389]: "Issues Concerning the Scientific and Technical Situation and Strengthening Management of Science and Technology--An Interview With Professor Kang Zhenhuang [1600 2182 7806], Vice-Governor of Sichuan Province"]

[Excerpts] The Sichuan Provincial Scientific and Technological [S&T] Advisory Group, consisting of 541 experts, was established in September 1983. It is a "group of masterminds" organized at the request of the provincial CPC committee and government. It is a brain trust established to assist the provincial CPC committee and government in leading S&T and economic construction. After full deliberations of all members, this advisory group elected its own leading organ--the committee of the advisory group. The chairman of this committee is Professor Kang Zhenhuang, whom I have interviewed.

Professor Kang Zhenhuang was born 1 June 1920. He has studied in the United States and received a master's degree from the Department of Aeronautical Engineering in the College of Engineering at New York University. After he returned to China in March 1949, he became a professor at Chongqing University, professor and dean of the College of Engineering at Sichuan University, professor and assistant dean of studies at Chengdu Engineering Institute and professor, chairman of the Department of Mechanics and vice president at Chengdu S&T University. He is now vice-governor of Sichuan Province, a large province with a population of 100 million, in charge of S&T, education, public health and physical education.

Professor Kang is a famous scientist in China. He has great achievements in mechanics. He is a member of the board of directors at China's Society of Mechanics and chairman of the board of directors at the Sichuan Provincial Society of Mechanics. He pays great attention to developing mechanics on a broader plane and makes this old science glow with new life. Over the years, he has devoted himself to combining mechanics with biology and medicine and made contributions to the growth and development of biomechanics in China. Because of this, he was elected chairman of the national biomechanics special commission. In 1980, he attended the Gordon Biomedical Engineering Seminar held in the United States at the special invitation of Professor Mao Zhaoxian [3029 2507 2009], chairman of the seminar and director of the biomechanics research unit at the Rensselaer Institute of Technology in the United States. At the seminar and at several

American universities, Professor Kang delivered an academic paper, "The Development of Biomedical Engineering in China," which was highly praised. In 1983 several international seminars were held in China. For example, the "Biomechanics Seminar," sponsored by China, Japan and the United States with the participation of scholars from seven countries, was held in May in Wuhan; the "Asian Hydromechanics Seminar" was held in November in Beijing, and the "International Artificial Organs and Blood Circulation Seminar" was held in November in Tianjin. Professor Kang was invited to deliver academic reports at some seminars and presided over others as a member of Chinese preparation committee.

Professor Kang is not only a scientist but also a managerial expert who is good at coordinating, analyzing and organizing. He displayed to a certain degree his managerial ability when he led the work of scientific research and when he worked as chairman of academic departments, as vice president and as vice governor. He was my professor when I studied at college. Later we worked a long time together at a school. Therefore, I know a little about his knowledge and ability. In order to collect contributions for the section "A Scientist's Talk on Management," the editorial department of SCIENTIOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY, asked me to do a special interview with Professor Kang, requesting that he publish his opinions on the subject of S&T management.

Professor Kang said: "In order to discuss the issue of S&T management, we must first of all understand the situation on the S&T front. If we do not have a clear understanding of this situation, it will be very difficult for us to talk about the tasks. The situation on China's S&T front is very good and promising. This is not just a "polite formula." Particularly in the past 2 years, this situation has been very noticeable. It has several characteristics and expressions:

1. S&T and education, which is an important basis of S&T, have been placed in an important position by the state. Speeches delivered by leading comrades of the central authorities such as Deng Xiaoping, Hu Yaobang and Zhao Ziyang as well as documents and measures adopted by the central authorities indicate the great importance that has been attached to the work of S&T and education. We are deeply impressed ourselves. The work of S&T and education has never before received so much attention. We should not underestimate this trend because it has epoch-making significance. China has never attached so much importance to this work since liberation, not to mention the years before liberation. This is a distinctive characteristic of our time. S&T personnel are all inspired with enthusiasm.

2. Our society has generated a strong demand for S&T. In rural areas, S&T personnel are called "Gods of Wealth," and everyone is inviting and vying for them. Industrial and other departments are also looking for S&T personnel to work as their advisers, offer consultative services and solve major S&T problems. This has never happened before. Or shall we say, this has never been so widespread before. This explains why such ideas as "S&T are productive forces," "S&T are the key to the achievement of the four modernizations" and "revitalizing the economy must depend on technological progress" have not only struck deep roots in the hearts of the people but also have become an actual need of society. Engels once said: "Economic needs have been the major motive force of our progress in understanding nature, which is now becoming more so." Engels also said: "Once there is a demand for technology in society, this demand will push science forward better than 10 universities could." The strong demand for S&T in our society will certainly play an important role in accelerating S&T development in China.

3. Intellectuals including S&T personnel have received unprecedented public recognition in regard to their status and roles. This is inseparable from what the CPC Central Committee has been vigorously advocating. A few years ago the CPC Central Committee clearly pointed out that the whole intellectual contingent in China has changed and become a component of the workers contingent. It noted that Chinese intellectuals had many good moral characteristics, such as being hard working, patriotic and willing to integrate with workers and peasants. In the past few years, the CPC Central Committee has repeatedly advocated the need to establish a sound practice of "respecting knowledge and intellectuals" throughout society. It has repeatedly demanded and adopted various effective measures to bring into full play the important roles of intellectuals in socialist modernization. Some traditional social prejudice against intellectuals is now changing. All this has substantially aroused the initiative of S&T personnel and their sense of responsibility as being masters. Everything in the world must depend on people. People are the most valuable factor. By the same token, S&T work depends on S&T personnel to carry it out. Now that the social status of S&T personnel has been affirmed and recognized by society, their roles have been brought into full play and their initiative has been aroused, they must become a strong internal motive force in developing China's S&T undertakings.

4. The academic exchanges between China and foreign countries have been markedly strengthened. Marx said in "Das Kapital" that scientific labor is ordinary social labor, which is "partially conditioned by the coordination of contemporaries and partially conditioned by the utilization of predecessors' labor." Conducting academic exchanges is an important aspect of what Marx called "coordination of contemporaries." Based on his experience in academic meetings and exchanges between China and foreign countries, Professor Kang specifically explained that academic exchanges between China and foreign countries in the past few years have been markedly strengthened. The strengthening of such academic exchanges has been very helpful to the promotion of studies, the stimulation of creativity and the training of competent personnel.

If we can see the excellent situation on our S&T front, we will have greater confidence in pushing S&T forward. Stated above are the characteristics and expressions of our excellent S&T situation. They are also the favorable conditions which we should fully utilize to do a good job in S&T work.

After discussing the S&T situation, Professor Kang changed the subject to the question of how to do a good job in managing the work of S&T organizations. He said S&T management work is becoming increasingly important. To look at the work of such organizational management in a broader sense, we need to strengthen the work in the following areas:

1. Strengthen the S&T information work. Without the link of information, it will be very difficult to make any achievements in scientific research. The reason that the Chengdu University of Science and Technology was able to do some work and make some achievements in biomechanics in the past few years has something to do with the fact that this university carried out more exchanges with foreign countries and acquired more knowledge in this regard. However, modern science is different from the science of the past. In the past when scientific

knowledge was relatively simple, researchers were able to collect pertinent information on their own. Today the intellectual information of modern science is as vast as the open sea; therefore, it is far too insufficient to depend on the ability of individual researchers to collect information. This inevitably results in the social division of labor in scientific activities, requiring that some people specialize in the information service and bringing about the specialization and socialization of information work. Therefore, information work must become an important work target of the whole S&T management. For example, in Sichuan Province the provincial S&T commission has an S&T information office. Some larger scientific research units also have information offices or sections. A great deal of work has been done in the past, but the information work still cannot meet the needs and no information network has really been established. At present, some people engage in research and others in information work, but they do not cooperate very well. Their work is incoherent. In sum, how to adapt the information service to the needs of S&T work, how to set up a real information system and how to establish a close link between information and research work--these are questions we need to solve in the management of S&T organizations.

2. Strengthen coordination work. Coordination involves many fields. There is coordination between S&T and social and economic development as well as among S&T activities. Coordination has been carried out in some fields but not in others, such as the field of interdisciplinary studies. Modern science is different from science in the past. It is very difficult to tell which fields of study many scientific research activities belong to. For example, the research of biomechanics involved the science of medicine, engineering and materials. Many technological problems need to be solved by the coordination of various fields of study. Professor Kang said that he was engaging in the study of biomechanics, but he did not understand very much about biology. It takes the next few generations to train people who can understand biology, materials and engineering. Therefore, there is a question of how to coordinate interdisciplinary studies. Who should be in charge of such coordination? Experts or leaders? This may become a field of study in itself in foreign countries. In our socialist country, this question needs to be solved by our departments in charge of the management of S&T organizations. Our failure in carrying out some projects is related to our failure in coordinating interdisciplinary studies. In scientific research, we need to have "echelon formation" as well as "horizontal links." The former is very important but sometimes the latter is even more important.

3. Strengthen policy-making work. Policy-making is a very important component of management. Correct policy decisions can create very good results. Wrong policy decisions can cause serious losses. To do a good job in policy-making, it is necessary to do a good job in examination work. The CPC Central Committee and the state emphasize that all major policy decisions must be fully examined. The purpose in doing so is to guarantee that they can make correct policy decisions and avoid committing mistakes in policy-making. We have been doing policy examination work. Some is done well; some is not. Some is affected by abnormal factors such as accommodation and consideration for personal feelings and relations. To make a success of the examination work, we need to have a

complete set of strict and scientific guiding principles from the standards of evaluation to the working methods. The general standards of evaluation for examining major projects concern the field of subjective conditions, national needs, social compatibility and expected investment results. These fields can be divided into several standards that are more specific and easy to follow in the evaluation so as to form a system of evaluation targets. We should notice that scientific research is a complex social activity going on inside the system of the society. Therefore, it has to react to various changing factors. They are interrelated and affect and condition each other. In the examination of policy decisions, we often have to analyze and compare many projects, weigh the pros and cons and select the one that is most satisfactory. To do so, we need to have a large amount of data as our basis. Social phenomena are not determined by a sole factor. They are subordinate to the law of statistics. Without sufficient data, it will be very difficult to do a good job in the examination work. If the examination work is unsatisfactory, it will be very difficult to make correct policy decisions. In sum, how to do a good job in policy-making is not a simple matter. There is much learning involved.

4. Strengthen the popularization of S&T results. This work is an important as laboratory work. It is an important link concerning whether S&T can be transformed into direct productive forces. This link is important because it is between S&T and production. However, because it is between S&T and production, it is also easily ignored by the people and becomes a field where neither S&T nor enterprise management is concerned. Everyone now has a much better understanding of the popularization of S&T results. On the one hand, comrades engaging in S&T show more concern for the popularization and utilization of scientific research results than they did before and consider it as the principle that S&T must be oriented to socialist modernization; on the other hand, comrades engaging in production also show more concern for the popularization and utilization of S&T results than they did before and consider it as the principle that production growth and economic revitalization must depend on S&T progress. However, judged by our work, problems such as who should be in charge of the organizational management in this field, who should study such problems and who should provide tentative plans have not yet been properly solved. In a broader sense, S&T management should include the popularization and utilization of S&T results as a research subject and work content. Of course, in a broader sense, enterprise management should also include this. Therefore, both are now concerned with work which neither was concerned about before. Now that both are concerned, there is a coordination problem. Who should be in charge of this coordination? How do we coordinate between them? Do we need a special organ to take care of this? These questions need to be studied further.

In conclusion, Professor Kang talked about the issue of education. S&T development is inseparable from education. S&T development should be coordinated with the development of education. To develop education, we need to do a good job in evaluating the potential competence of personnel. If such an evaluation is not linked to S&T development, it will be inaccurate. Conversely, if S&T development is not based on the assignment of competent personnel, it will not be easily materialized. We have carried out several mechanical projects in the past. Due to the personnel problem, we had great difficulty completing our projects. In short, the issue of S&T is an issue of personnel. The CPC Central Committee and the state now pay great attention, unprecedently great attention, to S&T, management and education. This definitely will effectively promote China's socialist modernization and bring about great progress.

12302
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STRENGTHENING POPULARIZATION, APPLICATION OF RESEARCH RESULTS URGED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENTOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 11, Nov 83 p 1

[Article by Shi Hequn [2457 7729 5028] and Wang Jiancheng [3769 1696 2052]: "Strengthen and Stress the Work of Science and Technology Development"]

[Text] Science and technology development is the process of popularizing the results of scientific research and applying them in production in order to boost social economic results. Generally, it includes two parts: one, applying existing scientific and technological results in factories and enterprises, thus tapping production potential; two, building bridges between scientific research and production, in accordance with social and production needs to tackle key scientific and technological problems. Both parts are very important to scientific and technological progress and production development.

Every research achievement requires the infusion of a great deal of money, facilities, manpower and time. But in what ways are research results being popularized and applied? Of the 240 inventions awarded prizes in China in recent years, only 45, or 18.5 percent, have been popularized and applied. At the 1982 Scientific and Technological Cooperation and Exchange Exhibition in Shanghai, 2,600 scientific research achievements were on display; however, popularization and application contracts were signed for only 566 of them, or 21.4 percent. The Scientific Commission of Heilongjiang Province reported 307 scientific research achievements in 1982. Seventy were actually popularized and applied, accounting for a mere 22.8 percent.

Why are large numbers of scientific research results not being popularized and applied? As I see it, some of the reasons have to do with the research departments, some with the production departments, and some with the science and technology policies.

Research departments are often so preoccupied with scientific research that they ignore the issues involved in really popularizing and applying research results. In defining a research topic, some researchers fail to take production needs as their premise and lack adequate investigation and scientific evidence.

Even when such research bears fruit, it will be divorced from objective needs. Some research topics do take into account production needs; however, owing to the absence of adequate market forecasts and economic demonstration, the economic results of popularization are insignificant. There are other research achievements which are free from the above weaknesses. Nevertheless, they are rushed into production without being properly put through the intermediate stage of industrial testing. Consequently, many problems arise which directly undermine their social economic results.

Some plants and enterprises which are working at full capacity turning out popular products lack a sense of urgency about applying research results. In addition, there are short-sighted enterprises which make light of science and technology development and begrudge the investments made in it. Production departments have so far failed to solve the problems of production development and economic vitalization through the 'pressure, dynamism and power' of science and technology.

The present policies to promote the transfer of scientific and technological results, rewarding the popularization of such results, and supporting new technologies and new products, etc., are still flawed and incomplete and need further examination. Our failure to seriously resolve these crucial policy issues has affected the popularization and application of scientific and technological results.

Numerous facts at home and abroad prove that the development of science and technology is essential to economic development and production growth. To accomplish this task requires the conscientious work of specialized agencies, specialized organizations, and specialized personnel. This specialized contingent should systematically investigate, analyze, and appraise scientific research achievements on all fronts; have a broad understanding of social needs; and adopt effective measures to bring about popularization and application. Moreover, this contingent should coordinate the 'five scientific and technological armies'; launch a coordinated attack to solve existing production problems; bring together research departments and production departments; assist research departments in the correct choice of research topics; help production departments in the formulation of development plans; and draw up plans of implementation which are feasible.

The development of science and technology has a glorious future and plays a crucial role in the realization of the strategic objectives of economic vitalization. It is the road China must travel to develop its economy and accelerate its technological advancement. However, the development of science and technology is still a very weak link; the related theoretical research remains uncharted territory. Therefore, we cannot afford to lose any time in stressing and strengthening the work of science and technology development.

12581
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ROLE OF DEVELOPMENT BANKS IN REFORM OF SCIENCE, TECHNOLOGY

Beijing GUANGMING RIBAO in Chinese 7 May 84 p 1

[Article by Wang Sanhou [3769 0005 0624] of Nankai University: "The Establishment of Scientific-Technological Development Banks Anticipated"]

[Text] At present, some research institutes that are engaged in the work of developing, popularizing and applying technology are beginning to implement a paid contract system, I believe that it is very important to establish appropriate scientific and technological development banks. With the establishment of scientific and technological development banks, it becomes possible to achieve a coordination in the economic relations among scientific research units as well as between scientific research units and production units, and to activate the functional role of planned management and supervision of the scientific research activities.

As an independent domain of intellectual production, science and technology have something in common with the production activities of industry and agriculture, but they also have a peculiarity of their own, notably the unique motion pattern of the funds of the scientific research units. This requires that specialized banks similar to agricultural banks--scientific and technological development banks--be established to meet the needs of China's reform of the scientific and technological system. This will play the following roles in the economic activity of the scientific research units.

1. Scientific and technological development banks, by putting the economic lever to work, can increase the utilization rate of funds. In reality, some research institutes have had a lot of funds, but are temporarily not going to use them; whereas other research institutes need funds urgently, but are without a source of funds. In these circumstances, the scientific and technological development banks can regulate surpluses and deficiencies.

2. The scientific and technological development banks, by checking up on loan projects, can discover and control the unnecessary repetition of research topics. The banks can provide low-interest preferential loans for use in research projects urgently required in the state economic construction, and they can set up "risk funds" for use in development of new technology. The scientific and technological

development banks can also employ economic methods to assist some research institutes in tackling key problems with joint efforts and help them achieve in their scientific research activities an integration of immediate interests with long-range interests and of partial interests with interests of the whole.

3. The scientific research units, after the implementation of a paid contract system, gain profits by transferring their achievements and by other methods. Whether fees are charged reasonably for a transfer of achievements or not can easily create disputes between scientific research units and production units. The scientific and technological development banks, by weighing the magnitude of the economic results of achievements and the situation of how funds are set in motion in the scientific research units, through consultations and other means, can determine a reasonable price for the transfer of achievements. Meanwhile, because banks are doing the professional economic work of transfer, the scientific and technological units do not have to establish professional organizations of a same nature, or they may reduce the size of their staff.

4. The scientific and technological development banks can provide the production units with a portion of the development banks for use in new techniques, new technology, and new products, can build up the "strength" of enterprises relying on technological progress, and can speed up popularization and application of new technology.

5. Scientific research funds for basic research topics will still be appropriated by the state, but the state appropriation of operating funds can go directly to the scientific and technological development banks, which allocate the funds in accordance with needs, by stages and in batches, ensuring that special funds are earmarked for specific purposes only, and that funds temporarily not used are kept in banks as revolving funds. This not only helps to improve the utilization rate of funds, but also avoids the diversion of scientific research funds to other purposes.

12315
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CAS PROMOTES COOPERATION IN USE OF EQUIPMENT

Beijing GUANGMING RIBAO in Chinese 9 May 84 p 2

[Report by GUANGMING RIBAO correspondent Zheng Haining [6774 3189 1380]: "Chinese Academy of Sciences Breaks Interdepartmental Blockade, Promotes Cooperation in Joint Use of Large Equipment"]

[Text] The Chinese Academy of Sciences has shattered in recent years the interdepartmental blockade and developed cooperation in sharing the use of large equipment, thereby effectively raising the utilization rate of large equipment and promoting the development of scientific research and production, this correspondent learned recently at a Working Conference of the Chinese Academy of Sciences on the Management of Large Equipment held in Beijing.

Along with the development of science and technology, large precision equipment is becoming more sophisticated, automated, and resourceful; technology is becoming more complex daily; and is also becoming more costly. Every year the CAS uses 55 percent of its state-appropriated operating funds on procurement and installation of instruments and equipment. Because of poor management, the utilization rate of many large instruments is very low, and this has created tremendous wastes.

In order to bring into full play the role of large equipment in scientific research and production, the CAS has carried out a measure of fixed rating of the large equipment under its supervision and adopted an economic measure of collecting fees for the instruments used, thus promoting various forms and patterns of cooperation in sharing the use of equipment: by pooling large equipment to form first-grade public laboratories at the research institute level; or by adopting measures of decentralized or centralized installation of equipment in line with local conditions and by organizing the various regional research institutes to cooperate in sharing the use of equipment; or by using a topic as the unit to organize a specially-supervised center to share the use of equipment, under a cooperative relationship established through a pattern of agreements. By making a change in the former irrational practices of fitting and installing instruments in the topics section, the Shenyang Institute of Metals has moved a large portion of its large equipment out of the problem section to form 13 special laboratories (stations), thereby bringing into existence a technological system of the institute, establishing a management system for the various types of large equipment, a system of personal responsibility, and a system of rewards and penalties.

Cooperation in sharing the use of large equipment has increased the utilization rate of equipment, reduced the scientific and technological personnel's use of time on routine matters, facilitated the acceleration of scientific research progress, and achieved marked economic results in production and services.

12315
CSO: 4008/320

LOW PROFIT OF NEW PRODUCTS DAMPENS ENTERPRISE ENTHUSIASM IN NEW TECHNOLOGY

Beijing GUANGMING RIBAO in Chinese 7 May 84 p 1

[Article by Mu Gongqian [4476 1872 6197], Wang Lin [3769 2651], Huang Shengli [7806 0524 0448], of China Research Center for Promotion and Development of Science and Technology: "Three Measures to Reform State Management of Research Institutes"]

[Text] Reform of the scientific research system, viewed from the domain of management, consists of two aspects. One is reform of the internal management of research institutes, and the other is reform of the state relevant department's management of research institutes. On the latter aspect of reform, we believe that three measures are worthy of specific attention:

--The Establishment and Perfection of a Technological Market. In order to carry out a renumerative contract system, it is necessary to recognize first the commodity attributes of scientific and technological results. If, economically, scientific and technological results cannot obtain an appropriate price, scientific research units would be unable to survive without relying on state operating funds, and we would be in no position to talk about a renumerative contract system. A compensatory transfer of scientific and technological results requires that there is a market for technology, that channels of circulation are open for technology, and that compensatory trade is developed for technology. In recent years, the establishment in some cities and departments of various patterns of exchange such as scientific and technological exchange centers and technological service companies has attained gratifying results in pulling strings and building bridges to enhance the popularization and application of scientific and technological achievements. Nevertheless, because authoritative and law-orientated administrative organizations and management measures governing a compensatory transfer of technology have not yet been established in China, and because a stable nationwide market for technology has not yet been formed; therefore, scientific and technical results are mostly in a state of spontaneous popularization and natural transfer. This is manifested conspicuously in: on the one hand, information is limited in scope, and technology transfer is extremely difficult; on the other hand, there is no unified economic evaluation of scientific and technological results, technology is of little worth, and gratuitous transfer or symbolic compensatory transfer of the possession of technology remains quite common. It is, therefore, very necessary to establish and bring to perfection China's technological market, which will lay a social foundation for reform of the scientific and technological system.

--The Building of Intermediate Testing Grounds. The means of intermediate testing is an important link in the chain of a speedy transformation of the scientific and technological results into productive forces. Excellent intermediate testing conditions may bring about a fast transformation of achievements into products, a quick occupation of markets, and a favorable stimulation of enterprise enthusiasm in purchasing new achievements and new technology. Prior to the establishment of a technological market, this is particularly important to the research and development units that have replaced their operation outlays with a renumerative contract system. According to investigations, the research institutes which have administered the economic measures for trial implementation relatively well are all equipped with intermediate testing workshops or factories. There are, however, many research institutes which today still do not possess the means of intermediate testing, and even in places like Shanghai, where technological forces and productive capacities are relatively solid and abundant, more than 50 percent of the regional research institutes do not possess the conditions of intermediate testing. Therefore, it is necessary to focus specific attention on the building of intermediate testing grounds. This does not mean that each research institute must set up an intermediate testing workshop and factory, but that one may adopt another pattern of integrating factories with research institutes and of combining scientific research with production.

--The Formulation of an Economic Policy to Assist Enterprises in Developing New Products. An investigation of 472 factories by the Shanghai Joint Section for Development of New Products has shown that the average profit rate of the costs of new products is generally lower than that of the old products. For example, the average profit rate of the pressurized vacuum flasks sold in the country is as low as 10 percent, but that of the old products, including the king-size pressurized vacuum flasks, is as high as 25 percent. The result is that the higher the output of new products goes up, the lower the average profit rate of enterprises comes down. This certainly will have an impact on the enthusiasm of enterprises in adoption of new technology and in development of new products, thereby making it difficult for the scientific research units to dig out problems from enterprises and for the realization of a compensatory transfer of the scientific research results. It is, therefore, necessary to formulate for the enterprises as soon as possible an appropriate economic policy of promoting the development of new products and the popularization of new technology, thus eliminating and limiting obsolete products and backward technology. New products should be entitled to a preferential treatment, in the areas of loans, reduction of tax revenues, and trial sale prices, with funding for scientific and technological achievements and for technical transformation merged into production costs.

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SHANGHAI WORKS ON LONG-TERM TECHNOLOGY PLAN

OW090830 Beijing XINHUA in English 0742 GMT 9 May 84

[Text] Shanghai, 9 May (XINHUA)--Shanghai, the biggest industrial city of China, will focus on research and development of a number of new technologies in its Seventh Five-Year Plan (1986-1990). The Shanghai Science and Technology Commission is now working on a local long-term plan (1986-2000) for the development of science and technology.

Subjects include super large integrated circuits, industrial production for computer software, structural materials, optical fiber communications systems and single-film optical fiber, production of insulin and hepatitis vaccine by genetic engineering, development of offshore oil resources and industrial robots.

The city will set up eight industrial systems for micro-electronics, computers, optical fibers, lasers, the manufacture of nuclear power plant equipment, the manufacture of offshore oil equipment, modern materials and software.

Shanghai also plans to improve basic scientific research covering solid physics, molecular biology and applied chemistry.

It will introduce foreign technologies to tackle some key problems in the construction of high-rise buildings, overall control of the Huangpu River, pollution control in more than 300 major enterprises, communications and environmental protection.

The new plan also includes projects to raise the commodity rate of agricultural products and by-products by applying specialized techniques with grain, vegetables, fish, poultry and animal husbandry.

The city will also make efforts in the diagnosis and treatment of cancer, cerebrovascular disease, heart disease, hepatitis, and also expand its immunization program.

Shanghai has a strong technical workforce but plans to train more. The number of scientists will increase from the present 300,000 to 500,000.

During the last three years, Shanghai attained more than 1,900 scientific achievements, of which 56 winning national invention prizes, 10 percent of the national total.

Liu Zhenyuan, vice mayor of Shanghai, said at a recent city conference on science and technology that the plan is feasible based on present local economic, social, scientific and educational conditions, and world science and technology.

NEW TECHNOLOGY EXPERIMENT BASES IN SHANGHAI

OW050904 Beijing XINHUA in English 0750 GMT 5 May 84

[Text] Shanghai, 5 May (XINHUA)--Preparations for setting up four industrial experiment bases for new technologies are underway here under the supervision of the Chinese Academy of Sciences and the Shanghai municipality.

These pilot plants are:

--the Shanghai biological engineering experimental base, which will provide innovations for the manufacture of foods, medicines, light industrial products and chemicals;

--a base for experiments in producing new organic and inorganic chemical materials, including special high polymers, engineering ceramics, functional ceramics, artificial crystals, optical fibers and films;

--a base for the research and development of large-scale integrated circuits;

--and a base for the study and application of radiation technology for vegetable and fruit preservation.

The bases are scheduled for completion in 1987.

CSO: 4010/90

SHANGHAI MAKES PROGRESS IN SCIENCE, CULTURE

OW260759 Beijing XINHUA in English 0633 GMT 26 Apr 84

[Text] Shanghai, 26 Apr (XINHUA)--Shanghai, one of China's major scientific, cultural and educational centers, has 711 research institutions with a scientific and technical force of 370,000 including 280,000 engaged in natural science research.

Scientists in the city completed more than 2,500 successful pieces of research between 1980 and 1983. Eighty-three won state invention awards and some are up to advanced world standards.

Much of the research has been applied in industry and agriculture across the country, playing an important part in national economic development.

The city's scientific institutes, colleges, universities and production departments frequently cooperate on state and major local research projects. New progress has been registered in large-scale integrated circuits, computing technology, optical fiber communications, superconductor technology, environmental protection, energy utilization, protection and control of lung, liver and stomach cancers and infectious hepatitis, breeding of fine rice strains, catalysts, atomic energy, space technology and infrared remote sensing. Research on life sciences, calculating geometry and bridge mechanics has also reached a new level.

Shanghai is now building bases for biological engineering, new chemical materials, applied radiation technology and development of large-scale integrated circuits.

The city has set up a number of technical service organizations for scientific and technical information, measuring and testing technology, development of computer software, and technology development, and international scientific exchange.

The 100,000-member Shanghai association for science and technology has 108 societies headed by prominent scientists and scholars.

There are 45 regular universities and colleges in Shanghai, 21 more than in 1965. They include the world-renowned Fudan University, Jiaotong University, Tongji University, the East China Teachers' University, the Shanghai Foreign Languages Institute and the Shanghai No 1 Medical College. The newly-built Shanghai University, with faculties of literature, engineering, foreign languages and industrial and commercial management, enrolled its first students last summer.

More than 78,000 students are now studying in universities and colleges in Shanghai, 50 percent in science and engineering, 11 percent in teacher training and 9 percent in medicine. The city also has more than 3,600 graduate students. It is expected that students at universities and colleges will number 100,000 by 1985.

These educational institutions have been active in academic exchanges with other countries. Fudan, Tongji and others have established relations with over 100 universities in several countries, including California, Harvard and Cornell Universities in the United States.

Two to three hundred foreign experts are invited to lecture in Shanghai each year. On the other hand, Shanghai has sent more than 1,000 teachers for advanced studies or to lecture and 1,000 students to study abroad.

In recent years, Shanghai has greatly developed adult education. It has a television university and 115 workers' spare-time colleges with an enrollment of 30,000. Another 60,000 adults are on training courses.

There are 520,000 students in the city's 900 middle schools, and 790,000 pupils in 3,200 primary schools. Ninety-nine point seven percent of all school-age children in Shanghai attend school. Shanghai has also set up 92 technical secondary schools.

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TECHNOLOGICAL DEVELOPMENT IN ZHU JIANG DELTA

Guangzhou YANGCHENG WANBAO in Chinese 8 Feb 84 p 2

[Article by Chen Quanjun [7115 6898 1498]: "Guangdong Province Specialists and Scholars Discuss Strategic Questions on the Development of Science and Technology in the Zhu Jiang Delta Economic Zone"]

[Text] At the end of last year the science committee of Guangdong Province held the "Strategic Conference on Scientific and Technological Development in the Zhu Jiang Delta Economic Zone." More than 40 professors, scholars, and specialists from relevant aspects of science and technology, economics, information, and management attended the meeting. They looked into the problems in the following three aspects.

I. The guiding ideology and goals of scientific and technological planning. Everyone unanimously agreed that the guiding ideology for scientific and technological planning in the Zhu Jiang Delta Economic Zone ought to be: full scale implementation of policies for scientific and technological work that are geared toward economic construction and economic development must rely on science and technology. They believe that the focal point of scientific and technological development should be determined according to the needs of the key developments for production and construction in the economic zone in order to facilitate the technological advancement of industry and agriculture. They felt that new trends in world scientific and technological developments should be noted and studied, and full use should be made of the many particular superiorities of the Zhu Jiang Delta's adjacent neighbors, Hong Kong and Macao, and of overseas Chinese. We should introduce, digest, and transfer advanced foreign technology to make a contribution to "quadrupling" throughout the province and country. The strategic goals for scientific and technological development are: strategic goals of national economic development centered on economic zones, which require that before 1995 the principal agricultural spheres, and the key trades and enterprises of traditional industry will universally use international advanced and suitable technology from the late 70's and the 80's; to reorganize industrial structures and technological structures into some new industries of concentrated know-how and technology, so that by the end of this century certain newly established technological fields will reach the international level of advancement at that time; to actively carry out intellectual development; to constantly increase the proportion of scientific and technological progress in the growth of the national economy, until the end of this century it should be one-half; to assimilate both foreign and

domestic scientific and technological results as starting points for development, to form an "independent" scientific research capability, thereby enabling the Zhu Jiang Delta Economic Zone to become one of China's most scientifically and technologically developed areas.

II. Handle correctly the relation between scientific and technological work and industrial and agricultural production. Scientific and technological work should closely serve industrial and agricultural production, accelerating the true transfer of the industry of the economic zone onto the track of being the center for improving economic results. In the industrial aspect, we want to continue to support the developmental impetus that gives priority to traditional light and textile industry, and to take full note of the enormous role of the exploitation and production of South China Sea petroleum, and to increase the proportion of industry that is relevant to it. We want to turn science and technology into production forces as soon as possible. In order to effectively digest, absorb, and transfer the technical equipment that is introduced, we should organize a Fanqiu [0646 3061] engineering system with Guangzhou as its center. Relevant technological policies must be formulated for technical transformation and import of technology, and we must limit and phase out technical equipment that consumes large amounts of energy and material, that is heavily polluting, and that is obsolete and outmoded. We must encourage the development and adoption of new technology, new crafts, new materials and new products to hasten the process of replacing the industrial technology structures. Under the prerequisite of resolutely guaranteeing food we ought to forcefully develop industrial crops and diversification with stress on sugar cane, silkworms and mulberry trees, hogs, poultry, pond fisheries, and fruit and vegetables, and we especially want to be able to provide high quality valuable products for trade and export. Opportunities for development lie in the cultivation of science. They key points: the first is to strengthen research on the inner physiological mechanisms of crops in order to obtain and select fine seeds and seedlings; the second is to solve the problems of batch resistance and quality breeding; the third is to normalize and broaden high quality high output regulations for scientific cultivation in line with local conditions to allow agriculture to have production engineering.

III. Develop new technologies in order to establish new industries. Everyone feels that we ought to establish new industries on the basis of research and expolitation of the following new and developing technologies:

A. Computers and software. As for the Zhu Jiang Delta, the development of microcomputers and applied technology is most important in the development of products like function distributed Chinese character microcomputer systems and office automation computer systems, manufacture of disk drives, console printers, terminal display equipment, etc. Developmental goals at this stage do not concern export, but are first for broader application in this area and throughout the country in general. We want to disseminate computers throughout every trade and industry, as well as to make software rise to the dominant position in the computer industry.

B. Information systems and information technology. In the world today energy resources, raw materials, and information are considered to be the three great

pillars of modern industry. In light of the information situation in the Zhu Jiang Delta and the urgent need for development we must first transform our current telecommunications lines, greatly increase our local and long distance numerically-controlled automatic switching equipment, improve the rate of dissemination of telephone equipment, as well as take steps toward the development of numeric transmission and optic fiber communications. Along with the development of data base technology, we should set up public data bases for the departments of economic management, industry, communications and transportation, trade, commerce, and science and technology, forming a modern information system with Guangzhou as its center and a corresponding public data transmission system connected to equipment in Beijing and Hong Kong.

C. Bioengineering. This includes microorganism engineering, enzyme engineering, cell engineering, and genetic engineering. The Zhu Jiang Delta has abundant agricultural resources, providing unlimited development prospects for bioengineering. Microorganism engineering can make full use of industrial organic waste water, molasses, bagasse, cassava, starch, etc., to make unicellular proteins, amino acids, lysine and other biochemical products; by exploiting in-depth processing we can encourage the rise of the feed industry, industries using proteins, and industries involved with nucleic acids and their derivatives. At the same time, we want to develop organization of technologies like cultivation, cell fusion, and enzyme fixation, and want to begin research on genetic engineering, which is revolutionizing contemporary biology.

D. Marine engineering service technologies. We must strive to prepare and develop the various chemical processing preparations for mud, platform repair technology and assorted equipment and apparatus needed for exploitation of the South China Sea oil, gradually reaching a point where we can replace imported products.

E. Energy conservation technology. According to forecasts for the supply and demand of future energy resources in the Zhu Jiang Delta, the primary methods of resolution will depend upon conservation, and we want to develop highly effective new products for energy conservation as well as embrace the conservation technology of those trades and products that are energy efficient.

In addition, we also want to intensify research on new type materials, precision machinery, fine chemical industry, and environmental sciences.

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SCIENCE ASSOCIATION CONFERENCE PUTS FORTH TASKS

Advisory Group Formed

Wuhan HUBEI RIBAO in Chinese 23 Jan 84 p 1

/Text/ The Second Congress of the Hubei Provincial Scientific and Technological /S&T/ Association concluded yesterday afternoon in Wuchang after a 5-day session.

Comrade Guan Guangfu /7070 1684 1381/, secretary of the provincial CPC Committee, delivered a report at the congress yesterday morning.

The congress elected 144 members to the provincial S&T Association. At the first plenary session of the congreee, Liu Jiankang /0491 1696 1660/ was elected chairman; Cao Ye /2580 6851/, Huang Shuhuai /7806 2885 2849/, Qi Minyou /7871 3046 0645/, Zhang Chunming /1728 2504 6900/, Xu Houze /6079 0624 3419/, Li Huifeng /2621 6540 1144/, Huang Yongkai /7806 3057 2818/, Wang Jibao /3076 0679 1405/, (female), Ye Nianguo /0673 1819 0948/, Chen Dingya /7115 1353 0068/, Zhang Guanghao /1728 0342 4110/ and Gu Guang /6253 0342/, totalling 12 persons, were elected vice chairmen; and Ai Minkang /5337 3046 1660/, Liu Yunqian /0491 4596 6197/, Sun Darong /1327 1129 1369/, Li Jinyong /2621 0093 1661/, Li Zaigunag /3076 0686 2494/, Yang Wenan /2799 2429 1344/, Gu Renan /7357 0117 1344/ and Tang Minxiong /0781 2404 7160/, totalling nine persons, were elected standing committee members. Yang Wenan was also elected secretary general.

Ten senior scientists and leading cadres, Tao Shuceng /7118 6615 2582/, Wu Xianwen /0124 3759 2429/, Zhang Wencai /4545 2429 2088/, Fang Jun /2455 0193/, Li Guoping /2621 0948 1627/, Gao Shangyin /7559 1424 5593/, Qiu Fazu /5941 3127 4371/, Zhao Xuetian /6392 1331 3944/, Zhang Ruijin /1728 3843 3866/ and Guo Xin /6753 2946/ formed an advisory group of the provincial S&T Association.

In his report, Comrade Guan Guangfu first affirmed that this congress is a gathering of outstanding workers to discuss matters of vital importance, a magnificent meeting of great significance to speed up S&T progress and invigorate the economy in Hubei Province and a mobilization meeting to arouse the enthusiasm of S&T workers and create new prospects for the S&T work in the province.

Comrade Guan Guangfu emphasized that if Hubei wants to be in the van of the four modernizations drive, it must rely on advanced S&T and gear its S&T work to economic construction. He discussed 10 issues. First, understanding the

situation and clarifying the urgent need for the broad masses of S&T workers in economic construction. He said that S&T are developing at a tremendous pace throughout the world. New products, materials and technologies are constantly emerging. Departments of microelectronics technology, genetic engineering, optical fiber communications and new energy resources are stimulating new breakthroughs. Some industries are transferring from capital- and labor-intensive models to knowledge- and technology-intensive models. Many experts believe that the world is now on the eve of a new technological revolution. This is a serious challenge to us, as well as a good opportunity for us to catch up with others. Our domestic situation is excellent. It urges us to move along. If our province wants to advance in the van of the national drive of the four modernizations, we must make our S&T advance in the front. Second, thoroughly implementing China's basic principle for modernization--"economic revitalization must rely on advanced S&T and S&T work must be geared to economic construction." With regard to the implementation of this principle, our province has done a great deal of work and scored great achievements. Consequently, the appearance of our province has substantially changed. However, this is just the beginning. Our development is still uneven. The implementation of the S&T principle is a process of repeated study, cognition and practice. All party and government cadres, including those in charge of economic affairs, and S&T workers must make further efforts to conscientiously study, understand and firmly implement this principle and consider it a guiding ideology for all work. Third, S&T tasks for Hubei Province. According to the demands of the fourth provincial CPC Congress, general targets for Hubei's technical development at present and for some time to come are as follows: By the end of this century, major industries, especially key enterprises, should generally adopt advanced technology suited to our needs and widely adopted by economically developed countries in the 1970's or early 1980's. Those with conditions should strive to adopt advanced technology that matches the international level of the 1990's. An S&T system with Hubei's characteristics should be established in accordance with the crucial problems of the province and its advantageous conditions in regard to natural resources, products and industries.

Ensuring that the best steel is used to make the knife's edge, S&T workers should create down-to-earth results in promoting economic construction. Fourth, issues concerning S&T plans. In order to choose correct S&T tasks and effectively carry out S&T work, we must have a scientific and practical S&T plan. This plan must be able to implement the principle of coordinating economic, S&T and social development, focus on local characteristics and bring into play local strong points. It should include long-term and overall arrangements and emphasize major current problems. Fifth, vigorously organizing S&T coordination. We should not only create conditions for institutions of higher education and scientific research units in our province to fulfill major scientific research tasks assigned by the state but also organize them through various forms to participate in the economic construction projects of our province. We should adopt various means, use various channels and try in a hundred and one ways to strengthen horizontal links, organize coordination and genuinely bring into play our strong points in S&T to accelerate economic revitalization. At the same time, we should pay attention to the coordination of natural sciences and social sciences. Sixth, gradually reforming the S&T system and enacting policies that encourage S&T improvement. The general orientation of the reform should

be favorable for the close integration of production and S&T and for the utilization of talented personnel. Seventh, further implementing policies on intellectuals. We should cultivate a social practice that respects knowledge. Everyone must be able to use his talent. S&T workers must be encouraged to boldly explore and blaze new trails. Eighth, improving the political and professional quality of S&T workers. Ninth, consolidating the work of S&T associations, strengthening the organizational construction of S&T associations at all levels and bringing their functions into full play. Taking advantage of the fact that S&T associations have a galaxy of talented people, abundant intellectual resources, horizontal links and the coordination of multiple academic departments, we should make S&T associations a real link between the party and S&T workers and a real assistant to the party in leading S&T work. The provincial CPC Committee has conducted a special discussion of S&T work, using the provincial S&T association to allocate a certain amount of funds to build a provincial S&T exhibition hall, an S&T education institute and a science popularization publishing house. Prefectural and city S&T associations should become independent organizations. In principle, county S&T associations should also gradually become independent. Tenth, improving and strengthening party leadership over S&T work. The foundation of the four modernizations is education, and its key is S&T. Therefore, S&T must be advancing in the very front. Party organizations must have a knowledge of S&T and be familiar with intellectuals. They must improve their understanding of the position and role of S&T work in the four modernizations. They must thoroughly understand the party's S&T principles and policies and the party's intellectual policies and strengthen their ties to S&T workers, experts and scholars.

The afternoon closing ceremony of the congress adopted the "Resolution on the Work Report of the Second Congress of the Hubei Provincial S&T Association." Chairman Liu Jiankang delivered a closing speech at the ceremony.

Pei Lisheng /5952 7787 3932/, vice chairman of the Chinese S&T Association, delivered a speech at the congress on the morning of 20 January.

An exhibition of S&T consulting services results was also held during the congress.

Association's Impact on Economic Growth

Wuhan HUBEI RIBAO in Chinese 23 Jan 84 p 1

/Editorial: "Strive to Create a New Situation in the Work of the Provincial S&T Association"/

/Text/ The Second Congress of the Hubei Provincial S&T Association has concluded successfully. This is a mobilization rally aimed at creating a new prospect for the work of the provincial S&T association. The congress set forth a number of glorious tasks for the provincial S&T association to enact under the new situation. They are very inspiring. We may say that since the first congress, which was held 25 years ago, this is another magnificent meeting of great significance in the development history of S&T mass organizations in our province.

In the past 20 years or so, especially in the past 6 years following the 3d Plenary Session of the 11th CPC Central Committee, the provincial S&T association has done a great deal of work and scored abundant achievements in uniting and organizing the broad masses of S&T workers to develop S&T and promote our economic construction, in popularizing S&T knowledge, in training qualified personnel for the four modernizations and in carrying out domestic and international academic exchanges. Facts prove that economic construction should depend on S&T and that S&T work should be geared to economic construction. S&T associations are important mass organizations needed by the party and the people in the four modernizati ons. Along with the development of the S&T revolution and China's four modernizations, they will become more dynamic and active daily.

This S&T congress has implemented the spirit of the fourth provincial CPC Congress. The provincial CPC congress clarified the strategic goals for economic and social development in Hubei Province by the end of this century and called upon Hubei Province to advance in the van of the four modernizations. The provincial CPC congress also demanded that by the end of this century most major industries, especially key enterprises, adopt advanced technology suited to our needs and widely adopted in economically developed countries in the 1970's and early 1980's. It urged enterprises with conditions to r each the international level of the 1990's. This strategic goal has created a vast world where the broad masses of S&T workers and S&T associations at all levels can bring their abilities and functions into full play. S&T associations should continue to uphold the principle that S&T should serve the national economy, take advantage of the strong point that they have many talented members, a variety of academic departments, intense knowledge and easy access to information and guide and organize S&T workers of all trades and professions through various channels and forms to help solve S&T problems in the four modernizations, transfer S&T achivements into productive forces and make contributions to fulfilling the strategic goal for the economic development in Hubei Province. S&T associations also shoulder such tasks as popularizing S&T knowledge, vigorously developing intellectual resources and training and recommending outstanding S&T workers. Doing a good job in these tasks is to render better service to the socialist modernization.

We are now in a world in which S&T is developing by leaps and bounds. Applying technological breakthroughs to production and society can increase social productivity tremendously. If we seize the opportunity to catch up with others in utilizing new technology, we can directly usher in a new era of economy and technology and narrow the economic and technological gaps between us and the developed countries. S&T associations should bring into full play their strong points, pay close attention to the newest development of the technological revolution, actively carry out studies of fledgling sciences, vigorously exchange and introduce new achivements and information on natural sciences in accordance with the needs of the mdoernization drive and enact academic activities to accelerate the development of fledgling sciences.

S&T associations are organizations of scientists and S&T workers as well as a brigade linking the party and the broad masses of S&T workers. S&T associations at all levels should vigorously advocate the Marxist view on respecting knowledge

and talented people, uniting new and old S&T workers to better implement the party's intellectual policies, show concern for intellectuals politically, ideologically and in living standards, actively reflect their opinions and demands to the party, make S&T associations a real home for S&T workers and create favorable conditions for arousing their enthusiasm.

This congress elected new leading organs for S&T associations, providing a new organizational guarantee for fulfilling the glorious tasks of the provincial S&T association. We believe that this congress will open up a new page in the work of the provincial S&T association and the development of S&T undertakings in Hubei Province.

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HEBEI S&T AWARDS RALLY HELD

S&T Importance Stressed

Shijiazhuang HEBEI RIBAO in Chinese 2 Jan 84 p 1

/Text/ At the Hebei Provincial Science and Technology /S&T/ Achievements Award Rally, held on the morning of 29 December 1983, leading comrades of the provincial CPC committee, the standing committee of the provincial NPC committee, the provincial government and the provincial CPPCC committee presented trophies and certificates to the winners of the 1982 S&T achievements awards and the representatives of advanced units distinguished for accelerating economic development by improving techniques.

Judged by the provincial S&T evaluation committee, 152 scientific research and development projects received S&T achievement awards. Two projects that attained advanced international standards won first prize; 20 meeting the advanced domestic standards or with breakthroughs in certain areas won second prize; 67 won third prize; and 63 won fourth prize. Of all the prize-winning projects, 126 have been popularized and used in production with good economic results. Enterprises using these achievements have witnessed an annual increase of 170 million yuan in output value and 50 million yuan in taxes and profit delivery.

To encourage the practice of accelerating economic development by improving techniques and to promote the rapid transfer of S&T achievements into productive forces, the rally presented the S&T improvement awards, the first of its kind in Hebei Province, to 52 units which have distinguished themselves in accelerating economic development by improving techniques. Ten units won first prize. Their per-capita tax payment and profit delivery was over 5,000 yuan. The scope of their technological improvement and the ratio between their output value and the taxes and profits they delivered to the state were both up to the advanced domestic standards.

Lu Chuanzan /0712 0278 6363/, standing committee member of the provincial CPC committee, delivered a speech at the rally. He said: "This is the fourth provincial S&T awards rally since the 3d Plenary Session of the 11th CPC Central Committee. It indicates the concern of the party and government for S&T work and the encouragement and expectations of the people throughout the province for S&T workers. On behalf of the provincial CPC committee, the standing committee of the provincial NPC committee, the provincial government and the

provincial CPPCC committee, I hereby extend warm congratulations and heartfelt gratitude to all participants of the rally and all comrades who have scored outstanding achievements."

In his speech, Comrade Lu Chuanzan relayed the spirit of the recent national S&T work conference and emphatically discussed ways to further implement the principle--"economic construction must rely on S&T and S&T must serve economic construction"--which was set forth by the CPC Central Committee. He said: "This is a basic principle for our national modernization. If we do not depend on advanced S&T, we will be unable to fulfill the strategic goal of quadrupling production set forth by the 12th CPC Congress. We are confronting a new industrial revolution in the world. S&T is developing extremely fast. This could be a challenge as well as an opportunity for us. We must conscientiously study countermeasures. In other words, if we have correct judgment and measures, we can skip certain development stages of traditional industries, narrow the gaps and accelerate the development of economic construction."

Comrade Lu Chuanzan said: "We should notice that our S&T work still cannot meet the needs of the four modernizations and that there still is a large gap between our S&T level and the advanced level of neighboring provinces and municipalities. We should set a grand goal: to work hard to catch up with other advanced provinces in the country by quickly building Hebei into a culturally developed, scientifically and technologically advanced and economically prosperous province."

Comrade Lu Chuanzan emphasized: "Party and government organs at all levels must consider the implementation of the basic principles as an important task for adhering to the line set forth by the 3d Plenary Session of the 11th CPC Central Committee, a major policy for fulfilling the strategic goal of the 12th CPC Congress and a focus of their work. They should include it in their daily work schedule and pay close attention to it. Principal party and government leading comrades at all levels must personally attend to S&T work to help create an environment and social practice respecting knowledge and talented people. The broad masses of cadres and people should be educated to genuinely understand and implement this principle. Changing this principle into popular practice takes time and effort. However, until this problem is solved, achieving the four modernizations is hopeless. No matter what, we must devote our whole life to this cause, because this is to hold ourselves responsible to the people. All economic departments should thoroughly understand the strategic sighificance of this principle and the profound impact it will have on economic and social development. To be able to do so is a great change. To initiate this change, all ideas and habits not in accordance with principle must be eliminated, and all obstacles must be removed. Comrades engaged in economic construction should study modern sciences and management with great enthusiasm and an enterprising spirit. They should constantly study and pay close attention to the latest S&T development and newest technology at home and abroad. At the same time, they should link their studies to the improvement of the current situation in Hebei Province. Implementing this strategic principle to serve economic construction is the basic responsibility of the S&T front. S&T management departments and scientific research units at all levels and all S&T workers should enhance their understanding of the principle set forth by the CPC Central Committee. They

should notice that our S&T work lags behind others in catering to economic construction and that the new world industrial revolution poses a challenge to us. All S&T workers must have a strong sense of responsibility and urgency, display a death-defying spirit and go to the front of production and where conditions are the hardest to work together with workers, peasants and cadres, keep their noses to the grindstone and devote themselves to fulfilling the great cause of the four modernizations."

In conclusion, Comrade Lu Chuanzan said: "In the new year we will confront new and arduous tasks. We wish that all comrades of the economic and S&T front in our province will make greater efforts in work, create outstanding achievements and make new contributions to revitalizing Hebei Province."

Editorial Hails S&T Rally

Shijiazhuang HEBEI RIBAO in Chinese 2 Jan 84 p 1

/Editorial: "Raise the Sense of Responsibility and Urgency to Rely on Science and Technology"/

/Text/ The recent provincial science and technology /S&T/ awards rally was another gathering of outstanding workers on the S&T front in our province. It was also a mobilization rally to call on the people throughout the province to go all out to improve S&T and voluntarily rely on S&T to revitalize the economy.

After the 3d Plenary Session of the 11th CPC Central Committee, the CPC Central Committee and the State Council set forth a principle of coordinated development for S&T, economy and society. At the 1982 national S&T awards rally, Comrade Zhao Ziyang, on behalf of the CPC Central Committee, elaborated on the relations between S&T and economic construction. He clearly and briefly pointed out: "Economic construction must rely on S&T, and S&T must be geared to economic construction." This is not only a guiding principle for our S&T work but also a basic principle for China's modernization drive. Whether this principle is implemented concerns whether the strategic goal of quadrupling production set forth by the 12th CPC Congress can be fulfilled. If this principle is implemented, success will be certain. If not, there will be a danger that nothing will develop. Therefore, people throughout the province must raise their consciousness of implementing this basic principle and continuously enhance their sense of responsibility and urgency to rely on S&T to revitalize the economy.

In the past few years, our province has done a great deal of work to implement this basic principl and has scored many achievements. The orientation of S&T work is getting clearer. The relationship between S&T and economic work is getting closer. More and more cadres and masses understand the important role of S&T. Rural areas have witnessed an upsurge in studying and applying sciences. A number of towns and enterprises have relied on S&T to develop their production and revitalize the economy. The enthusiasm of the broad masses of S&T workers is increasing. They have worked hard to study and develop agricultural and industrial production techniques. They have participated in wide-ranging activities concerning major economic and social policies. Many have been promoted to leading bodies at all levels. They have studied and popularized many S&T

achievements which have played an important role and created good economic results in the technical transformation of the national economy and the movement of increasing production and practicing economy. According to a survey of 157 popularizing S&T achievements, some 16 million yuan of investment in 4 years created a net profit of over 2 billion yuan. Practice proves that the basic principle of the CPC Central Committee is correct, practical and very powerful to promoting S&T and economic construction.

However, we have been unable to thoroughly understand and effectively implement this principle. Quite a few comrades, especially those in charge of economic, party and government work, do not have adequate understanding of the crucial role played by S&T in economic construction. They have not genuinely established the idea of relying on advanced S&T to do a good job in economic construction. They pay attention only to production and capital construction and ignore S&T work and the technical transformation of existing enterprises. As a result, they are unable to utilize and popularize many S&T achivements in a timely manner. According to statistics of departments concerned, only 25 percent of all new techniques and achievements conscientiously developed by S&T workers have been put into practical use and popularized. Others lay idle. Many localities and enterprises which urgently need and have conditions to adopt new techniques have been using old technology year after year to manufacture old products which are not competitive and have poor economic results. Why? A major cause is that many leaders and cadres in charge of economic management and technology lack knowledge in modern S&T. Some are not interested in it. Some think they know it all. They are slow in catching up with the newest S&T knowledge and development at home and abroad. They do not have the enthusiasm to continue to inquire about information year after year, month after month and week after week. If this state of mind is not changed immediately, the basic principle of the CPC Central Committee will not be implemented in our province, revitalizing Hebei will become an empty slogan and fulfilling the four modernizations will become hopeless. Therefore, we must have a clear understanding of this situation.

An important task facing the leaders at all levels and the masses in our province is to make further efforts to study, understand and practice and strategic principle set forth by the CPC Central Committee--"economic construction must rely on S&T and S&T must be geared to economic construction." Because implementing this principle determines the success or failure of the modernization drive. The most urgent and important thing is to quickly increase our ability to solve major problems in our economic construction. We are facing a new world industrial revolution. S&T is developing extremely fast. The number of fledgling techniques and industries is increasing constantly. This provides us with a good opportunity of development as well as a serious challenge. If we do not face reality and seize this opportunity to quicken our steps in a down-to-earth manner, our gaps will become even larger 10 or 20 years from now. We will not be able to win the battle.

A new year has begun. The new tasks confronting us are both arduous and glorious. All comrades of economic and S&T fronts throughout the province should brace themselves and go all out and accept the challenge of the "new world industrial revolution."

12302
CSO: 4008/169

SEIZE THE OPPORTUNITY, USHER IN THE NEW TECHNOLOGICAL REVOLUTION

Beijing RED FLAG in Chinese No 6, 16 Mar 84 pp 2-5

[Article by Ma Hong [7456 3163]]

[Text] Today, an upsurge of a new technological revolution has appeared in the world. In the industrially developed states such as the United States, Japan, and the European countries, voluminous articles and publications have been written touching on this phase of development, offering diversified viewpoints and sounding various calls which have, in varying degrees, reflected the development and use of new information technologies (including microwave technology, optical fiber, and so forth), biological engineering, new types of materials, new energy resources and oceanological development. This is well worth our attention.

The emergence and development of new technologies and new industries have given birth to doctrines of all shades and forms on social sciences among Western capitalist scholars. We should earnestly analyze the different theories of these scholars on the basis of Marxist stand, viewpoint, and methodology, and absorb those things that conform to science but reject those that are unscientific. These Western scholars, perfectly aware that the capitalist society is in an extremely precarious state and being anxious to show or explain that capitalism will not necessarily perish, have placed their hopes on a new technological revolution or industrial revolution ushering in a "marvelous and new era" and enabling capitalism to last forever. Our attitude must therefore be scientific, analytical, and critical. Nevertheless, concerning their forecast that the scientific revolution will score a major breakthrough, and that it will bring about a development in the social productive force, and new changes in social life, it is indeed worthwhile noting and deserves to be studied seriously. Moreover, we should, based on the actual conditions of our country, formulate the relevant countermeasures. If we can grasp this opportunity, and, in accordance with the concrete state of our country and our available conditions, selectively use the fruits of the new technologies and speed up our economic development, we can narrow the gap between ourselves and the developed countries in economy and technology; otherwise, if we lose the opportunity, the gap between us and the world's advanced level will be widened.

In the face of the rise and development of new technologies and new industries in the world, we can take different kinds of attitudes: First, we may consider these new technologies and new industries as being still far away and hence be little concerned with them, in fact close our eyes to them, and fail to understand and even not wish to understand the situation at all; or second, we may be anxious for results, anxious to adopt at once all the newest technologies and develop the newest industries, paying no regard to the actual national condition, divorcing ourselves from reality, and acting blindly; third, we can give proper regard to reality, note the direction of the new development, and, in accordance with our needs and capability, fully utilize the new technologies to develop our own economy and technology. The last-mentioned attitude, a Marxist one, should be the one for us to adopt. Briefly, it is: Seize the opportunity to receive the new technological revolution.

History has told us that there has always been an imbalance in the development of the productive force and scientific technology of the human society. The advanced may not always remain advanced, while the backward may not always stay backward. There have been numerous instances of the advanced becoming backward, the backward becoming advanced and those behind catching up with those in front both now and in ancient times and in this country and abroad. This may be said to be a law in itself. In the prolonged process of the industrialization of the capitalist countries, Britain used to be in the leading position but was later surpassed by the United States and Germany. In recent years, in certain respects, Japan has surpassed the United States. At present, in the development of new technologies in the fields of information technology, biological engineering, and new industries, Britain and certain West European countries have, generally speaking, fallen behind the United States and Japan. Facts have shown that if relatively backward states can adopt an appropriate economic development strategy and technological policy, they can, in subsequent development, take a leading place. Although at present our country is still in a relatively backward state, it hardly means that we shall be backward forever.

In the high tide of the new technological revolution, if we can promptly grasp the opportunity and utilize the advantageous conditions, we can surely speed up our development and be able to narrow the gap between us and the developed countries in economy and technology and catch up or surpass the world's advanced level. Naturally, we must be practical and realistic in carrying out our country's economic construction, cannot violate the laws of historical development, and cannot skip at will the development stages that we must pass through, in the vain hope that modernization can be realized all at once. In this connection, we must learn from the past lessons derived from the so-called breakthroughs on a nationwide basis which called for accomplishing in only a few days the movement to realize the "ultrasonic wave," "piping and tubing," and the "agricultural mechanization" projects. By no means should we become hot-headed. But neither should we proceed at a snail's pace, or follow others in starting everything from the beginning. We have already built a definite foundation in economy and technology. The current enforcement of the policy of opening up our foreign relations can, in a planned manner, introduce for us certain useful new technologies. In

this way, it may be possible for us, in certain definite areas and without going through the traditional industrial technological stages, to directly use relatively advanced technological results, such as microwave apparatus, laser, optical fiber and other new techniques. On the side of agriculture, special attention should be given to the use of new technologies such as genetic engineering the sector of biological technology. A study of the concrete conditions in our country will reveal that by the end of this century, the technological production structures in our country will still be on many levels--some using automation in operation, some mechanized, some semimechanized while some will still have to depend on manual labor. Our target is to enable our country's production technological level by the end of this century generally to reach the level that existed in the world's advanced countries at the end of the 1970's and the beginning of the 1980's. At the same time, the technology and craftsmanship of certain of our departments and of certain projects are to reach, by that time, the world's advanced level.

In recent years, Western economy has for a prolonged period been in a state of "stagflation." Various traditional industries such as iron and steel, textiles, shipbuilding and motor-car manufacturing are all falling off, sinking like the setting sun. Various developed countries, including some newly risen and semi-industrialized countries and regions are all striving to be the first to develop new technologies and build new industries to find a way out, concentrating their major effort on undertaking the newest technologies and the newest industries. However, certain traditional industrial products are not only sorely needed by our own country but are indispensable to the developed countries and developing countries as well. On our part, we should still grasp the opportunity and do an even better job of producing them, increasing their varieties, improving their quality, and lowering their cost of production. In this way we shall be able not only to meet our internal needs but also to export some of the products.

Following the adoption by the developed countries of new technologies such as microwave machines and others, certain labor-intensive industries will use new machines to replace manpower, and there will be no need to transfer some of the jobs to people in the developing countries. In addition, due to the use of new technologies, the dependence for material resources which the developed countries used to place on the developing countries will undergo changes to a certain degree. This will mean that certain of the superior points which developing countries are now enjoying (such as relatively larger and cheaper labor power, relative abundance in resources of the initial grade, and so on) will be curbed in varying degrees. In fact, we are currently facing the same situation. Hence, we must tightly grasp the opportunity and adopt the necessary countermeasures, otherwise we shall meet with many more difficulties in the days to come.

At the present stage of our socialist modernization program, we must as soon as possible formulate appropriate development strategies to meet the new situation. We must adopt correct policies and, in accordance with all possible conditions, absorb as many of the advanced technological results as possible, and speed up the healthy development of our economy and technology.

As for the development strategies for our economy and technology, we may select from several of the following:

First, the "copying" strategy. Whatever road others have taken in the past, we will follow today. Be it the road that the Soviet Union took or that taken by the Western countries, we will take the same road, that is, copy exactly their development strategy. For example, just as the West has said, following the completion of the so-called "third industrial revolution," we shall likewise begin the "fourth industrial revolution." Or, we may say, after passing through the development stage of the traditional industries, we shall enter into the development stage of the newly rising industries.

Second, the "catch up and surpass" strategy. This is what we adopted some time ago--the method of the "do a crash job" movement. It is also one that demands that within a relatively short period, in the main and even in everything, we catch up and surpass the level of the developed countries.

Third, the "closed-door" strategy. This implies the principle of "self-reliance and regeneration" within the country, holding that in everything, we shall start from the beginning, and that we not only refrain from adopting, but also categorically reject, foreign advanced technologies. We have already adopted this strategy once before.

Fourth, the "creating new" strategy. We do not follow the road taken by the developed countries, nor endeavor to "catch up" in everything, nor start everything from the beginning on the principle of "self-reliance and regeneration." On the contrary, we obey our national condition, fully utilize the advantageous opportunity of the moment and all available conditions, directly adopt the new technologies suitable to our needs to restructure our existing industries, and, on this basis and taking this as the starting point, appropriately develop new industrial branches.

Based on past experiences, of the four above-mentioned strategies, we should select the fourth one. In so doing, and in accordance with our national condition, we should attach special attention to the following points:

1. We have a population of 1 billion, of whom 800 million are peasants. The most important consideration is that each of these 1 billion people should have his own role to play and that his positive and creative qualities should be fully tapped so as to create more wealth for society and maintain our economic prosperity and social stability. At the same time, we should consider that we started from a poor foundation, that we are relatively short of capital, and that our strength in technology is also relatively weak. Hence, we must, on the one hand, under all possible conditions develop capital-intensive and information-intensive industries and must, on the other hand, pay attention to developing labor-intensive industries, particularly a combination of labor-intensive and information-intensive industries, to create products that have distinctive Chinese characteristics and are competitive in the markets. The proportion of the three above-mentioned types of industries should follow our country's concrete conditions. We cannot copy wholesale the patterns of the developed

countries. At the same time, we have a vast territory. The various localities are extremely uneven in economic development. Hence the proportion of the industries cannot be alike in all the localities. We should not all follow the same pattern.

2. Our country has a large number of medium-sized and small enterprises. A large number of the enterprises are scattered in the countryside (at present our country has about 400,000 industrial and transportation enterprises; plus the number of enterprises in the countryside, the total number exceeds over 1 million). Hence, we must develop those techniques that can be utilized by medium-sized and small enterprises, specialized households and households doing specialized jobs and in small towns and sideline occupations. We cannot take the urbanized road of a capitalist society, and concentrate, in the large and medium-sized cities, the several hundred millions of people in the countryside. It is necessary for us to develop industries in the countryside and have industry and agriculture combined, developing what Engels called villages with urban and rural superior points, that is, urbanization of the rural villages.

3. We must stress the development of those techniques that yield good economic results and are urgently needed by the country. We can depend on good economic results to accumulate funds for the development of new techniques, and again utilize these funds to further develop new techniques, in other words, depending on developing new techniques to further develop new techniques. Naturally, concerning those important projects that are urgently needed, investments must be made by the state but we must not solely depend on the state for everything. Only in this way is it advantageous to the speedy realization of the strategic targets fixed by the 12th CPC National Congress.

4. It is necessary to start from the existing condition of the national economy and employ those new techniques that are compatible with the present productivity and the productivity in the near future. We cannot divert from the present productivity, nor stay put at the present level, but must facilitate its improvement.

5. We must adopt those techniques that can rationally utilize resources, call for less investment but may economize on the use of material and energy. Although our country has a vast territory and is proverbially rich in resources, yet, on a per capita basis, our resources are by no means really rich. In fact, concerning certain resources we are below the world's average level. Therefore, we must treasure the resources and energy, and not waste them, but must by all means adopt those techniques that call for less investment but can economize on the use of material and energy.

6. We must strengthen the training of professionals and develop intellectual resources so as to raise the cultural and scientific standards of the nation as a whole. Existing staff members and workers, particularly engineering and technical personnel and management personnel, should pay special attention to updating their knowledge and seek economic results from knowledge, technology, management and information.

7. We must organize groups of superior and technical personnel to master newly emerging technologies for which China already has some grounding so that we can speedily grasp and apply those new techniques with the most important significance in the national economy.

8. It is necessary to study foreign trade work which conforms to the new situation and to plan and manufacture competitive export commodities, so as to raise even more foreign exchange funds for the purpose of developing the new techniques.

Many of the results in the world's development of new techniques and new industries are suitable for our adoption and many of them we can readily grasp after making some efforts and within a short space of time. This is true not only of the industrial sector but also of the agricultural sector. For example, take the case of genetic engineering in biological technology. As everybody knows, bean crops such as soya beans and peanuts, because they possess nitrogen-fixing nodule bacteria, can yield good crops despite a scanty application of fertilizer. According to incomplete statistics, each year the volume of nitrogen fixed in living organisms worldwide is about 175 million tons, equivalent to 200 to 300 percent of the gross volume of the world's output of nitrogenous fertilizer. On the other hand, crops such as paddy, wheat, and corn planted in our country, because their roots lack nodule bacteria, require the application of a large amount of nitrogenous fertilizer in order to have a high yield. Now, with the progress made in genetic engineering technology, some scientific research workers are studying the possibility of transplanting the nitrogen-fixing gene to the roots of paddy, wheat, and corn plants so that they can generate the functions of nitrogen-fixing and thus provide these crops with nitrogen. They are also studying how to directly transfer the nitrogen-fixing gene to the gene structure of unicellular crops, thereby producing new varieties of farm crops which can provide themselves with nitrogen-fixing. If this new technique in genetic engineering can be put to actual use in our country, it will embody an important and realistic significance in developing our country's agriculture and animal husbandry, in economizing on the use of energy, and in soil and water preservation and environment improvement. Following the successful experimentation on the planting of hybrid rice in our country, the yield of this new variety of rice has been high over a rather extensive area. Hence, if the other experiments mentioned above can be successfully carried out, they can be put into actual operation on a large scale. This is not something far in the future. Naturally, we must also note the complex nature of genetic engineering and the possibility of the harmful organisms it may bring to the human race. We must of course prevent the occurrence of a problem of this kind.

Our country has a rather weak economic foundation. In general, our production techniques are behind the advanced level in foreign countries by several tens of years. In the country as a whole, the scientific and cultural level of the vast masses of people is not high and, in the work of developing new techniques and new industries, we still suffer from such drawbacks as shortages in capital funds, material resources and technique equipment and also backwardness in the system of management. However, we

still enjoy many advantageous conditions. Over the past 30 years we have built up a fairly complete industrial and economic system and have made considerable progress in training our own scientists and technicians and mastering production technologies. For example, in the fields of computers, microwave technology, optical fiber information, laser technique, genetic engineering, raw materials and new forms of energy, a certain amount of research has been done and progress has been made in using them. These are favorable conditions for applying new technologies in certain branches of the economy. Moreover, there is another even more important condition--a basic one--we have a superior socialist system, the theoretical guidance of Marxism-Leninism-Mao Zedong Thought, and the party's strong leadership and its correct policies and guidelines since the 3d Plenary Session of the 11th CPC Central Committee. We are entirely capable of arousing to the maximum degree the enthusiasm of people of the whole nation, fully organizing the whole country's technical personnel, material resources, technology and financial power, and accomplishing many big things which the capitalist countries are unable to accomplish within a relatively short period of time.

The great Chinese people are a diligent, brave and sagacious race, possessing the will and capability to stand independently among the world's peoples. In the high tide of the development of new technologies and new industries in the world, we are entirely capable of seizing the opportunity, developing ourselves, realizing at an early date the gigantic strategic targets for the long-term development of the country formulated at the 12th CPC National Congress, and building a socialist modern power with special Chinese characteristics.

CSO: 4004/70

WAR INDUSTRY S&T PERSONNEL URGED TO AID OTHER INDUSTRIES

Beijing GUANGMING RIBAO in Chinese 9 Apr 84 p 1

[Article: "Fully Develop the Potential of Scientific and Technological Personnel of the War Industry Enterprises"]

[Text] The developmental history of modern science and technology [S&T] shows that certain new sciences and technologies are first designed for military purposes or used in the war industry and then transferred from military to civilian use, such as nuclear and space technologies. This situation also exists in China. Chinese war industry enterprises have great potential because they have fairly advanced S&T and a considerable number of technicians. Due to this, it is necessary to create various conditions and adopt proper measures to bring such potential into full play to accelerate the four modernizations.

At present, many local enterprises suffer a serious shortage of technicians and cannot find people to solve major technical problems and carry out technical transformation tasks, whereas some war industry enterprises let quite a few technicians remain idle with nothing to do. This is a loss to the state and the technicians themselves. If technicians have nothing to do, they will not have the opportunity to put their ability to good use and, as time goes by, their knowledge will become outdated. Waste of talented people is the biggest waste of all. If talented people cannot develop their talent and if talent cannot be fully utilized, the socialist principle of "from each according to his ability" would be violated.

To realize a rational flow of technicians from the war industry to civilian industries, first of all we should demand that leading comrades of the departments concerned and enterprises solve their ideological problems. We should continue to make vigorous efforts to publicize the idea that S&T is a productive force and make them understand why talented people are valuable assets of the state so that they would deeply regret the idleness and waste of talented people. At the same time, we should overcome departmentalism and establish the idea of "taking the whole country into account." As long as their ideological problems are solved, it would not be difficult for them to understand the necessity and urgency of ending the idleness of talented people and realizing the rational flow of talented people.

The rational flow of technicians from the war industry to civilian industries should be directed in an organized, guided and planned manner. Local government organs and the departments concerned should fully consult with war industry departments and make proper arrangements. As far as methods are concerned, we should proceed from facts and adopt different measures in accordance with different situations. We should not seek "uniformity." Based on the needs of local enterprises and the possibility of war industry enterprises, generally, three measures can be adopted: 1) Official transfer; 2) temporary transfer in which war industry technicians may go to work at local enterprises for a certain period of time while their families stay where they are and they may come back when their units need them; and 3) technical coordination in which war industry technicians provide technical services to local enterprises from their original units. With regard to the second and third measures, we may adopt the contract system and sign fee contracts to compensate war industry enterprises as well as their technicians, thus implementing the principle of to each according to his work. We suggest the departments concerned try these measures to see if they are effective.

12302
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HUBEI CONVENES PROVINCIAL S&T CONFERENCE

Conference Puts Forth Tasks

Wuhan HUBEI RIBAO in Chinese 10 May 84 p 1

[Article: "Scientific and Technological Work Must Be the Vanguard of the Four Modernizations"--passages between slantlines printed in boldface]

[Text] Over 400 responsible comrades concerned from various prefectures, cities, autonomous prefectures, counties, provincial organs, large plants and mines, institutions of higher education and scientific research units gathered at the Hongshan Hostel in Wuchang 4-9 May to discuss matters of vital importance to the scientific and technological [S&T] work of Hubei Province.

Guan Guangfu [7070 1684 1381], secretary of the Hubei Provincial CPC Committee; Qian Yunlu [6929 6663 6922], deputy secretary of the Hubei Provincial CPC Committee; and Tian Ying [3944 5391], deputy governor of Hubei Province, attended and spoke at the conference. Liang Shufen [2733 3219 5358], deputy governor of Hubei Province, relayed the guidelines of the national S&T work conference.

At the conference, Comrade Guan Guangfu dwelt on seven issues concerning Hubei's S&T work:

1. /Focus on the guiding factor and have a good understanding of the "rely on" ideology./ Comrade Guan Guangfu said: "The principle set forth by the central government that economic construction must rely on S&T and S&T must be geared to economic construction is a basic principle for realizing China's modernization. The first part 'rely on' and the second part 'be geared to' in this principle constitute a unity of opposites. They support and complement each other and both are indispensable. Without solving the issue of the second part, S&T work would lose its direction of advance in the four modernizations. Without solving the issue of the first part, the second part would lose its premise. However, as far as our party and government leaders at all levels are concerned, the guiding factor of the contradiction is to conscientiously solve the issue of the first part." Comrade Guan Guangfu emphasized: "At present, we must approach the issue that revitalizing the economy must rely on S&T from a higher level. This is an issue concerning whether or not we adhere to the basic principle of Marxism and maintain political and ideological unity with the central government. It is also an issue concerning whether or not Hubei can become the vanguard of the four modernizations."

2. /Clarify work focus and concentrate on doing a good job in the work of "transformation."/ He said: "S&T is a productive force, but a series of work including experiments, imports, transfer, training and popularization must be carried out before S&T results can be transformed into direct productive forces. Doing a good job in the work of 'transformation' is the key to combining S&T work and economic construction. When the transformation is carried out, the combination will also be realized. Without the transformation, there would be no combination." He pointed out: "When we emphasize the need to do a good job in the work of "transformation," we imply an important guiding ideology, that is: We should proceed from the actual conditions of Hubei's S&T standards and place the starting point of Hubei's S&T progress on the importation and assimilation of domestic and foreign advanced technology which is called 'gathering treasures' from the experience of the No 2 Automobile Plant. While implementing the principle of self-reliance in S&T work, we must proceed from reality and correctly combine creation, importation and assimilation. As Comrade Hu Yaobang pointed out during his recent inspection of Hubei Province, we should feel free to engage in extensive imports and open up to both foreign countries and other provinces to import and learn all of their good things (that are suitable for our use). Moreover, we should voluntarily strengthen the work of assimilation in the course and on the basis of imports. This is a road leading to greater, faster, better and more economic results and a short cut to S&T progress."

3. /Strength S&T work on the first line of industrial and agricultural production and lay a good foundation for S&T progress./ Comrade Guan Guangfu said: "The first line of industrial and agricultural production is where material wealth is directly created and where scientific research results are popularized through utilization. It is a basis for relying on S&T progress and realizing the transformation of S&T results into direct productive forces and economic results." He reiterated a demand set forth last year at the Hubei Provincial CPC Congress, that is: Plants and enterprises should change from a pure productive type to a productive-administrative type and then to a productive-S&T type or they should change to a combination of productive-S&T-administrative type. In rural areas, he said, special attention should be paid to developing specialized households into S&T households. He also emphasized the need to organize the coordinated process of scientific research and production, carry out various forms of S&T coordination between scientific research units and institutions of higher education and production units and give full play to the S&T advantage of scientific research units and institutions of higher education in Wuhan City.

4. /Reform the scientific research system and vitalize work in scientific research units./ He said: "In accordance with the guidelines of the central government and the actual conditions in Hubei Province, we should concentrate on doing a good job in the following areas. We should reform the utilization system of scientific research funds, change the method of eating from the 'same big pot' of state appropriations, implement the compensation principle and contract system that link scientific research work with economic results, charge for the use of scientific research funds, the transfer of scientific research results and S&T services, gradually live up to the principle of economic independence and assuming sole responsibility for one's own profits and

losses. We should expand the financial power of scientific research units; establish a system under which directors of research institutes (academies) assume responsibility; change the management system of S&T cadres and put S&T commissions in charge of S&T cadres under the leadership of party committees; gradually realize the flow of talented personnel and expand the power of scientific research units in using people." He urged departments concerned at the provincial level to continue to eliminate the influence of "leftist" ideas, emancipate their minds, conscientiously guide, support and participate in the S&T reform and get everyone involved in the work of "unbinding" to make Hubei's S&T undertakings develop and flourish.

5. /Pay close attention to S&T development plans and strengthen the planning of S&T work./ He said: /Only under the guidance of a comprehensive, systematic, long- and intermediate-term plan with insight can we have a broad and long-term view, take on overall responsibility and carry out the S&T work in a planned and effective manner. Otherwise, if we do it piecemeal, we are bound to get only half the result with twice the effort. This year Hubei Province should strive to draw up a plan for S&T development in the Seventh 5-Year Plan period and next year it should draw up an outline for S&T development by the year 2000."

6. /Go all out to establish advanced examples and use them to bring along work in all areas./ He said: "This conference has printed and distributed some materials on exemplary cases, among which I am most impressed with the No 2 Automobile Plant, the Huazhong Engineering School and Guangji County. The No 2 Automobile Plant relies on S&T progress to keep the enterprise always young and vigorous; the Huazhong Engineering School persists in combining teaching with scientific research and making scientific research serve economic construction and social development; and Guangji County closely relies on S&T to vigorously carry out comprehensive agricultural and scientific experiments. These experiences are worth spreading throughout the province." He said: "To popularize the experience of advanced examples, we should resolutely overcome various ideological obstacles. Party committees at all levels should adopt a clear-cut stand in establishing, supporting and popularizing advanced examples."

7. /Strengthen and improve the leadership over S&T work./ He said: "First of all, party committees and government organs at all levels should strengthen their leadership over S&T work, advocate decisions made at this conference and include the task of solving the 'be geared to' and 'rely on' issues in their agenda and principal responsible comrades of party and government organs should personally hear reports, administer research projects and solve problems arising in the course of implementing S&T policies. Second, it is necessary to expand the functions and responsibilities of the S&T commission to make it really become a comprehensive administrative department of S&T work throughout the province. Third, efforts should be made to strengthen the horizontal link and coordination among discipline inspection, economic and S&T commissions, insure that 'three spots are on one line' and make S&T and economic work really become an organic whole and develop in harmony. Fourth, it is necessary to strive to improve the conditions for S&T work and further implement policies toward intellectuals. Fifth, it is necessary to strengthen the ideological and political work among S&T personnel and carry out the

consolidation of local scientific research organs. Sixth, party and government leading cadres at all levels should take the lead in studying S&T knowledge and strive to become sensible persons in regard to the leadership of S&T work."

At the conference, representatives conscientiously studied related documents of the central government and understood the guidelines of the national S&T work conference. They exchanged experiences and carried out heated discussions around the speech of Comrade Guan Guangfu and the question of how to create a new situation in the S&T work of Hubei Province. Most of them said they had raised their understanding and enhanced their confidence and that they must bring back the guidelines of this conference and strive to make a relatively great breakthrough in the S&T work of their own region and unit.

The representatives also conducted conscientious discussion of the "Decision of the Hubei Provincial CPC Committee and People's Government on further strengthening S&T work" (draft for discussion). They started their ideological machines, aired their views in light of the reality and made many valuable suggestions.

Importance of S&T Stressed

Wuhan HUBEI RIBAO in Chinese 10 May 84 p 1

[Editorial: "Rely on S&T To Revitalize the Economy of Hubei Province"]

[Text] The Hubei Provincial S&T Work Conference successfully concluded 9 May. We congratulate the conference on its success. This conference relayed the guidelines of the national S&T work conference, studied central policies for developing S&T undertakings and summed up and exchanged the experiences gained by Hubei Province in S&T work in the past few years. The provincial CPC committee and government will make a decision on further strengthening the S&T work of Hubei Province. This will play a major role in pushing S&T work to advance in the forefront of the four modernizations in Hubei Province.

In the past few years, by implementing the strategic principle of the central government that "economic construction must rely on S&T and S&T must be geared to economic construction," Hubei Province scored gratifying achievements in S&T work. However, we should realize that our work still has a long way to go in meeting the requirements of the central government. The focus of China's S&T work is shifting further to the course of serving the economy, which is a strategic change. To adapt to and catch up with this change ideologically and make our province advance in the forefront of the four modernizations, we still need to make painstaking efforts to raise our understanding and solve actual problems. At present, the primary task is to further resolve the issue of understanding central policies. Some comrades lack a clear understanding of the important position and functions of S&T in the four modernizations. They include S&T in the field of ideology and consider S&T work to be nonessential. Other comrades fail to see the enormous role played by S&T after they are transformed into productive forces. They consider S&T development to be a slow remedy that cannot meet an emergency. Therefore, they always use production to promote production. As a result, these comrades cannot fully implement

the spirit of relying on S&T and attaching importance to knowledge and intellectuals put forward by the CPC Central Committee. Such understanding and attitude must be quickly changed or there would be no hope for the four modernizations.

"Science is a revolutionary force that functions as a motive force of history." Marx once gave a high evaluation to the enormous role played by S&T in the progress of mankind. He attributed nearly all the differences between the modern world and previous centuries to science. In some economically developed countries, over 60 percent of the growth in the national economy relies on S&T progress and 100 percent of many fledgling industries are generated by S&T development. Now S&T are experiencing a new revolution. Confronting the challenge posed by the new technological revolution, we should rouse ourselves and try hard to catch up with others in S&T progress.

Aside from other factors, the key to making Hubei Province advance in the forefront of the four modernizations is to rely on S&T progress. Hubei Province has a relatively good base for industry and has somewhat improved its economic results in the past few years. However, it still has a long way to go compared with advanced provinces and municipalities. Its technological progress is too slow, the equipment and technology of its enterprises are poor and the cultural and professional standards of its staff and workers' ranks are low. Aside from the factor that rural economic policies have not been properly eased and other factors in regard to agricultural lineup, backward agricultural S&T is a major cause of the decline in the national position of the agricultural economy in Hubei Province. To change this present situation, it is impractical to rely on increasing the capital construction investment and new enterprises. The most effective and substantial way is to rely on S&T. The Hubei Provincial Government has decided that in the next 4 years industrial departments should, on the basis of coordinating transformation, step up the technical transformation of 37 major products and 46 major enterprises producing the major products to make them meet advanced domestic standards and really become "hot-selling" products of Hubei's industry. The provincial government has also demanded that by 1987, 500 major new products be developed and over 500 old products be updated and improved to make them meet advanced domestic standards and make some of them meet advanced international standards in the late 1970's and early 1980's. All cities, counties and enterprises should draw up plans for creating quality and new products in accordance with these guidelines and carry out related S&T work in an organized and planned manner in accordance with those plans. For now and sometime to come, we should concentrate on doing a good job in importing advanced technology, organizing technological development and strengthening technological training. Through import and assimilation, we should form a new technological advantage, from one point to several points and then from several points to the whole area so as to speed up the national economic construction. At the same time, we should pay attention to using intelligence to develop intelligence, attach importance and give full play to the role of existing S&T personnel, further implement intellectual policies and better develop their intelligence and wisdom. At present, we especially need to use the spirit of reform to do a good job in such work. We should be bold in using reformers in all trades and professions.

Relying on S&T to revitalize Hubei's economy is an arduous and glorious task. Leading cadres at all levels and the people throughout Hubei Province should unite as one, help each other and strive to create a new situation in the S&T work in Hubei Province and make Hubei Province advance in the forefront of the four modernizations.

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REFORM OF SCIENTIFIC, TECHNOLOGICAL SYSTEM REVIEWED

Major Obstacles in Reform

Beijing GUANGMING RIBAO in Chinese 21 May 84 p 2

[Article by Fan Youde [5400 2589 1795]: "Technology Transfer Without Compensation and Excessive Economic Burdens Are Major Obstacles in the Reform of Research Institutes"; passages between slantlines printed in boldface]

[Text] /The Shandong Solicite Research Institute is a unit owned by the whole people which assumes sole responsibility for its own profits and losses. It has achieved over 40 scientific research results and has never received state appropriations for operating expenses since it was established 25 years ago. This unit not only has transferred research results without compensation but also has been forced to bear economic burdens of all descriptions./

In addition to supporting themselves and contributing over 8 million yuan of taxes to the state, over 230 staff members and workers of this institute have used their income to pay for over 7.7 million yuan of scientific research expenses, purchase over 30 units (sets) of large scientific research equipment, build scientific research buildings, physics and chemistry laboratories, ceramics trial-production buildings, dyestuff trial-production workshops and staff and workers' dormitories with a total floor space of 27,000 square meters. The gross value of the fixed assets now owned by this institute is 5.84 million yuan. /Since 1978, 53 scientific research personnel have achieved 14 major scientific research results, of which 2 won State Invention and Discovery Awards and 6 won the Scientific Research Achievements Awards of the Ministry of Light Industry./ The export price of Luyu porcelain, which they developed with local materials, is three times higher that of average export porcelain. The overall energy-saving efficiency of large turnnel kilns modified with the high-temperature heat-insulating refractory materials, which they developed, is as high as 25 percent. However, /due to various limitations, they can only contribute their scientific research results to production departments without compensation; they could not receive more rewards even if their performance were better and their contributions were greater./ Their average monthly salary is only over 50 yuan, and their annual bonus is only 1½-month's average salary. According to stipulations, 20 percent of the profits which they retained from the products of their middle-stage experiments were originally allowed to be used to award those staff members and workers who

have made greater contributions; however, the departments concerned forbade such use for "fear of affecting neighboring units." As a result, although leaders of this institute have set forth rules and regulations for scientific research responsibility system, due to the ceiling and limited amount of bonuses, it is difficult to fulfill the reward and penalty contracts and everybody has no choice but to eat from the 'same big pot' as usual.

The total amount of taxes they paid to the state accounts for over 50 percent of the total profits they earned from the sales of products. They also have to pay a management fee, which is 1 percent of the sales value of trial-produced products. Last year alone they paid 32,000 yuan in management fees. /The profit-sharing fund of this institute, which is 45 percent of its total profits, cannot be used in scientific research because most of it is exhausted by various external burdens./ Last year, as required by the local government, this institute used 15 percent of its profit-sharing fund to pay a road maintenance fee which plus other items totaled 45,000 yuan, accounting for 84 percent of the 54,000 yuan profit-sharing fund retained for the whole year. /It is impossible to accomplish anything with only 9,000 yuan left over from annual receipts./ To develop the cause of scientific research, research institutes must have a certain amount of money to cover their minimum expenses. /If this situation continues, this "goose" which lays eggs for the people but does not eat the "fodder" of the state will be unable to lay "eggs" as time passes as a result of chronic malnourishment./

At present, technology transfer without compensation plus excessive heavy economic burdens and the egalitarian distribution system have become major obstacles to the reform of the scientific and technological system in research institutes such as the Shandong Provincial Solicite Research Institute. How could we let such problems remain unresolved?

Taxes on New Technology

Beijing GUANGMING RIBAO in Chinese 21 May 84 p 2

[Article by Zheng Ruizeng [6774 3843 1073] and Zhang Fumin [1728 2105 3046] of the Tianjin Municipal Textile Industry Research Institute: "We Should 'Raise a Goose To Lay Eggs,' Not 'Kill a Goose To Get Eggs'"]

[Text] After local research institutes adopt the fee contract system and assume sole responsibility for their own profits and losses instead of relying on state appropriations for operating expenses, the departments concerned should adopt protective policies toward new technology. They especially should ease the tax policy. Our institute's research project on the new eddy spinning technology is covered by the contract we signed with the State Scientific and Technological Commission in 1981. The middle-stage experiment on research results of this project was carried out by us with loans and self-pooled funds. This new technology originally was not included in taxable items. However, in 1982, the departments concerned of Tianjin Municipality suddenly asked our institute to pay 2.06 million yuan of industrial and commercial taxes on this project for 1981 and 1982. Later, despite the mediation of concerned leaders in the municipal government, we still had to pay 980,000

yuan. In 1983, we again paid 1.2 million yuan. This seriously affected the normal progress of the development of this new technology. Helpless, we had to appeal to the departments concerned of the state several times. After dealing with various parties, the departments concerned of Tianjin Municipality finally agreed that no industrial and commercial taxes would be levied beginning in 1984.

Counting pennies while ignoring the big money in the development of new technology is the same as "killing a goose to get eggs." This is an ideological problem that must be properly solved in reforming the scientific and technological system. We should "raise a goose to lay eggs." For instance, using our institute's new eddy spinning technology in production has created great social and economic results. Last year our institute sent scientific and technological personnel to the Baoding Tailoring and Knitting Factory, which had suffered losses in consecutive years, to help them adopt the new eddy spinning technology. The technology was put into production in August last year. By the end of last year, this factory not only made up the losses it had in the first 6 months and issued wages and bonuses to its staff members and workers but also made a surplus of 60,000 yuan in profits. At present, this new technology has been used in over 200 textile plants in the provinces and municipalities of Tianjin, Beijing, Hebei, Shandong, Henan, Jiangsu and Zhejiang. It has also provided production conditions for a number of small neighborhood factories and solved the employment problem for nearly 10,000 jobless youth. New products made by these factories using this new technology have not only enjoyed great popularity on the domestic market but also entered the international market. If irrational taxes force our institute to stop experimenting with this new technology, it would not only cause our institute to lose nearly 10 million yuan of income for no reason but also cause the state to suffer immeasurable losses.

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NEED TO STRENGTHEN ROLE OF BASIC RESEARCH IN ECONOMIC CONSTRUCTION

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 1, 1984 pp 56-60

[Article by Zeng Decong [2582 1795 5115] of Xiamen University: "Some Theoretical Problems in Scientific Research Management at Institutions of Higher Learning"]

[Text] Education and science is one of the three major key strategies in the economic development of China. It is also a key issue in the realization of the socialist four modernizations. The leadership, teachers and research personnel in institutions of higher learning are devoting themselves to the realization of socialist modernization according to the objectives decided by the 12th Party Congress in order to fulfill the honorable mission given by history. However, the leaders in some institutions of higher learning are not aware of the new situation we are facing. They are not effectively preparing for the new situation of research in institutions of higher learning. One important reason is related to their understanding of some basic theoretical problems associated with scientific research in institutions of higher learning.

I. To Recognize "Double Centers" Again

"An institution of higher learning is a center for education as well as scientific research. It is an important force in scientific research." This is a diagnosis which summarizes the basic practice of education in China over the past years. It reveals the dialectical relation between higher learning and scientific research and is the guiding policy of institutions of higher learning in China. It is also the basic principle guiding the reform of institutions of higher learning in China. Institutions of higher learning are not only the major base for the training of special talents, but also are the major base for scientific research in the country. "Double Centers" basically explains the social function of institutions of higher learning, i.e. the position and function of institutions of higher learning in our country and the realization of the four modernizations, as well as the correlation between institutions of higher learning with society and the nation. It is debateable to use the "Double Centers" as the major view to handle the relation between teaching and research in institutions of higher learning.

An institution of higher learning, especially a key institution of higher learning which is becoming a scientific research center, must have a teaching

and research team at an advanced level, a modern scientific management system, as well as advanced equipment and library information needed to teach and conduct research. But this is not the fundamental sign for an institution of higher learning to become a research center. The most fundamental sign for an institution of higher learning to become a research center is that: it should stand on the leading edge of science in the major area of research. It should be able to cultivate high quality people to obtain research results of high standards. It should tackle some technical problems in the socialist four modernizations and resolve major key technical topics in economic construction.

It is usually considered natural to operate an institution of higher learning as an educational center. However, there are different views on operating an institution of higher learning as a scientific research center. We believe that institutions of higher learning have relatively complete disciplines and the technical strength at senior and middle levels is substantial; the teachers have a wide range of knowledge, solid theoretical basis and clear concepts; the foreign language level is generally high to understand scientific and technological developments and trends throughout the world; and it is capable of accepting, digesting and improving advanced foreign technologies and know-how to create design concepts with Chinese characteristics. In addition, there is an ever stronger reserve research team (graduate students and senior undergraduates) which is not yet fully recognized. These factors turn institutions of higher learning into a highly creative scientific and technological research team with complete disciplines and specialties at different levels. It is not only responsible for research on basic sciences but also responsible for research on applied sciences. It is not only suited for exploratory work in the direction of technical development, but also specializes in digesting imported technologies. It is not only suited for investigating comprehensive subjects but also appropriate to undertake single research projects. According to statistics in the "Index of Invention Awards" prepared by the State Science and Technology Commission, institutions of higher learning accounted for 95 out of the 340 inventions announced publicly from April 1979 to July 1982. According to statistics in the "Index of Awards in Natural Sciences" prepared by the State Commission, out of 122 natural science accomplishment awards evaluated by the Natural Science Award Committee in July 1982, 57 projects were authored primarily by institutions of higher learning, accounting for 46.72 percent of the total number. Out of six first-class awards, four were authored by institutions of higher learning, which accounted for 66 percent of the total number. This shows the position and role of institutions of higher learning on scientific research in China. It also shows that institutions of higher learning can become scientific research centers.

The recognition of the position and role of institutions of higher learning by the party and the people should be improved to overcome the traditional viewpoint that institutions of higher learning are for teaching only. The lack of attention to the research potential institutions of higher learning must be resolved by reminding the leadership and relevant departments to strengthen guidance and support. In terms of ideology, organization and investment, they should be operated as "Double Centers" based on the reality in China. From the viewpoint of an institution of higher learning, it should perform its own work well and contribute to the economic, technical and social development for

the nation, especially to the scientific and technical difficulties encountered in the four modernizations.

II. Given Priority to Teaching, Scientific Research as the Base

In institutions of higher learning, teaching and research are complementary. The contradiction is integrated. The purpose is to improve the quality of teaching in order to obtain high-level personnel and results. The central issue of higher education is to improve the quality of education.

Institutions of higher learning must insist on giving priority to teaching, which goes without any doubt. However, there are different views as for the position of scientific research. Some responsible school leaders often place scientific research in contrast to teaching. They do not see the role of research in teaching. Consequently, the effectiveness of using institutions of higher learning as an important research force is seriously hampered in some areas.

Practice tells us that scientific research is the forerunner promoting educational reforms. In the present era, developments in science and technology are sudden. Scientific research has become a joint "propeller" for the reforms in higher education and continuous improvement of teaching quality.

Teaching in institutions of higher learning must be continuously reformed and improved to suit the needs in technical development and the socialist four modernizations. Teachers can be urged to understand and grasp the history, status and trends of related research in their field by conducting scientific research. They begin to understand and know the requirements of the four modernizations. Consequently, the consciousness of teachers to reform and improve teaching is strengthened. The teachers are clear about the direction or reform and improvement. At the same time, their knowledge can be increased and vision widened. The depth, breadth and height of teaching can be increased. Teaching can become more scientific, advanced and vivid. Thus, the quality of teaching is continuously improved.

Scientific research is the parent for developing a new discipline. It is the embryo in breeding a new special field. As science continues to develop, new branch disciplines, cross disciplines and peripheral disciplines will emerge constantly. The need for talents in new disciplines will increase continuously with the development of the national economy, science and technology and the society. In the 30 years after liberation, students in institutions of higher learning and the development of special fields in China are summarized in the following table:

Item/Year	1955	1956	1957	1962	1965	1978
Total number of students	287,653	403,176	441,181	829,699	674,436	856,322
Number of special fields	249	313	323	627	601	819

The data in the table indicates that the development of higher education is closely linked to the development of specialized subjects under certain conditions. Although the establishment of new special fields may be realized by means of "introduction," "transplantation" and "effective combination," practice proves that only new special field established on the basis of long-term scientific research will have a relatively solid foundation (including manpower, materials, equipment, information and social connection) and more stronger vitality. We may say that without scientific research there is no new discipline, no new special field.

Scientific research is the premise for training graduate students. Training graduate students is the fundamental measure to accelerate the development of a large number of high-level research personnel and teaching staff in institutions of higher learning. However, the faculty in institutions of higher learning can only accept graduate students when they have solid and outstanding scientific research accomplishments. Then, they will be able to impose fundamental requirements and provide research direction for their graduate students to effectively guide their studies and research. To become a real advisor, it is not enough just to have past experience in scientific research (even one who has made outstanding contributions in the past). One must remain a scientist actively engaged in important research topics in the field of specialty. A teacher not involved in scientific research cannot be a competent advisor for graduate students. High-level graduate students frequently conduct high standard scientific research together with their advisors.

Scientific research is the cradle of teacher training. In order to improve the quality of education, it is necessary to raise the teachers' standards. The build up of a teaching team is the basis for construction of institutions of higher learning. Particularly because science and technology are rapidly advancing and the cycle of technical knowledge update is short, if teachers do not voluntarily study advanced scientific knowledge, they can hardly avoid the danger of becoming outdated in knowledge. There are many ways to improve the teaching staff, however, scientific research is one of the most important and essential. The process for teachers to conduct scientific research is the process for them to improve their studies. It is the process for teachers to replenish their knowledge and for the structure to become more rational, which is also a process for teachers to be continuously "modernized." Scientific research work is to explore the unknown and to create the future. It benefits the teachers in developing a broad view, the spirit to explore, courage to face difficulty and insight to be creative. The work involved in scientific research is difficult and honest labor. It inspires the wisdom of teachers and develops their hard working, dedicated, concentrated and rigorous qualities. It also develops a realistic style which links theories to the real world. Scientific research is the kind of work which involves the brain and the hands. It helps to stimulate and develop the abilities to think, observe, analyze, judge, create, resolve problems and use both the brain and the hands. Scientific research is frequently conducted as a struggle against error. It helps teachers to develop a fearless spirit to love and be devoted to science in order to pursue and protect the truth. Science is a career of the people. Especially in the

present era of "great science," scientific research activities will benefit the development of ideology and quality to accurately handle relationships between nations, collective bodies and individuals so that teachers are dedicated to the socialist homeland. All in all, conducting scientific research will benefit the teachers to develop communist ideology, morality, quality and style. Therefore, as long as it is led properly, the process of conducting scientific research is a process to continuously revolutionize the teachers ideology.

Scientific research is also an important bridge connecting institutions of higher learning to society. It is an important pivot to link theories to reality. It is also an important direct factor to attract attention and wide support of various classes in the society for institutions of higher learning.

In summary, no matter how we look at it, scientific research is a basic problem in developing and improving the quality of higher education. Without high standard scientific research, it is difficult to have quality education. In a sense, without scientific research, there is no true higher education.

To this end, all knowledgeable leaders in institutions of higher learning handle scientific research strategically. Those leaders who handle teaching alone or divide teaching from research cannot possibly run the institutions well.

Institutions of higher learning are an important force in science and technology. Conducting scientific research is an honorable historical mission for institutions of higher learning.

III. Intensify Applied Research, Emphasize Basic Research

Economic development must rely on science and technology. Scientific and technical work must be geared to the economy. Giving top priority to scientific and technological subjects with important economic results in the study of economic development is the guiding ideology of scientific and technological work in China. It accurately describes the dialectical relationship between science and technology, and economic development, which reflects the requirements of the party and the nation for science and technology. It hits the current drawbacks on the nail. It not only is the fundamental guideline to accurately handle the relation between scientific research in institutions of higher learning and the four modernizations, but also is the basic ideology to handle the relation between basic research and applied research in institutions of higher learning and to develop research contacts. This guideline was rapidly understood and grasped by leaders and the vast number of research managers and technical workers of institutions of higher learning. However, they have different degrees of understanding.

Some people hold the following view: Institutions of higher learning are mainly engaged in basic research, which is a historic experience determined by the characteristics of schools. Therefore, there are doubts and objections as to whether scientific and technological work should be geared to the

economy, especially in giving priority to scientific and technical subjects with important economic results in economic development. It seems that gearing science and technology to the economy is not compatible with the characteristics of schools. It seems that gearing science and technology to the economy must eliminate basic research. It seems that the ideology of gearing science and technology to the economy is not applicable to institutions of higher learning. This is incorrect.

Basic research is the foundation of applied and technological sciences. The results of basic research are important sources of scientific and technological developments. They are the necessary reserve for the development of new production techniques. Research on basic sciences at institutions of higher learning benefits the advantages of basic research and gives impetus to the development of applied and technical sciences, helps teachers to guide the students to understand various complex notions, and raises the quality of education. However, it does not mean that more manpower, materials and money must be devoted to basic research. Currently, even in economically developed nations the proportion of applied research and development is the greatest in the three types of research. The ratio of basic research, applied research and development in Japan, the United States and England is approximately 1:2:4. The proportion of basic research at some institutions of higher learning in economically developed nations is high. For example,* it was 43 percent in Italy, 50 percent in England, 69.1 percent in the United States and around 80 percent in Japan and France in 1969. This is because institutions of higher learning are better equipped to conduct research on basic theories. Most private corporations, however, are helpless in this area and basic research is not attractive to them.

The proportion of basic research in Japanese institutions of higher learning is the highest in the world, which also has a developmental process. Japan invaded China in the 1930's and scientific research in institutions of higher learning was militarized. Many testing research organizations were established to serve the war. After World War II, in order to rapidly restore its economy and reduce its technological gap with foreign countries, Japan imported a large number of technologies. Research units in institutions of higher learning such as Tokyo Imperial University undertook a large number of applied projects which were urgently needed by the country. Later on, other old imperial colleges also gradually established research institutes. Although a considerable number of them are research institutes aimed at application, in fact they carry out basic research. However, many scientific research organizations meant to perform basic research were conducting applied, and developmental research urgently needed by the country and the technical market. In the past, basic theoretical research has been conducted in institutions of higher learning. Presently, more and more national scientific research organizations are operated by private corporations. In order to make a "strategic turn around" to "dash toward the future," Japan actually began to emphasize basic research in the 1970's.

* 1970 for the United States and Japan.

We are working on the socialist modernization of China and are facing the giant and difficult strategic objective of the realization of the four modernizations and quadrupling the gross national product. It depends on progress in science and technology. However, there are few scientific and technical personnel and few funds for scientific research. It is necessary to weigh the priorities, and use the precious manpower, material and funding where they are needed most. Strength cannot be scattered. Under such conditions, the party Central Committee's proposal to "intensify research on applied sciences and emphasize research on basic sciences" is absolutely correct. It is a policy based on conditions in China and in agreement with the laws of science and technology as well as Marxism. We must give priorities to technical subjects with important economic results in the study of economic development, as well as applied topics. We must adapt a serious attitude and protective policy toward basic research, so that it develops on a stable basis. The guiding ideology and policy of the party Central Committee on science and technology are totally in agreement with the reality of institutions of higher learning. They must be thoroughly executed and used as the guideline to conduct adjustment and reform. Of course, different institutions of higher learning and different research units have varied concerns.

Institutions of higher learning share a basic characteristic, which is to be adaptable to economic, technological and social development. To insist on being geared to the economy and giving priority to key technical subjects with important economic benefits in economic development of the scientific and technological work is the fundamental link to promote the compatibility between institutions of higher learning and the four modernizations in China. It is an important driving force to promote high education reform. The guiding ideology of the party Central Committee on scientific and technological work accurately reflects this special feature of institutions of higher learning.

There is the problem of "giving correct names" in the implementation of this ideology. People involved in applied and development research are frequently seen as "poor standard." It seems that it does not meet a "standard scientific model" without numerous "new concepts" and complicated mathematical derivations. In fact, a theory is a summary of practical experience. It comes from practice and guides practice. A high-level theory is one which promotes social development. A high-level technology is one which is capable of generating huge economic results and promoting rapid socioeconomic development. That is, the effect on socioeconomic development and productivity should become a basic indicator of the standard of science and technology. Of course, the significance of some new discoveries is not clear. It is even more difficult to judge their economic results now. In addition to resolving the problem of "name correction" from political theories, it must be reflected in our specific policies. Scientific and technical personnel who work hard and contribute to economic development should be rewarded in spirit as well as in material.

The content of basic research is broad. There are many subjects, including topics directly and indirectly serving production, and directly motivating applicability and development, as well as on subjects which are not related to production for the moment and whose relation to production is still not understood. Basic research should not be considered unrelated to production.

Science is a revolutionary force with a promoting effect in history. However, not every discovery in any theoretical science can have a revolutionary effect on the development of productivity and history. Therefore, even with respect to the latter type of subjects, comrades who specialize in this type of research should be allowed to study them in peace according to the spirit of the party Central Committee. Their work should be respected. Being geared to the economy is not merely the job of those who are involved in applied research and development. Generally speaking, major technical difficulties often require the organization of resources in development, applied research and basic research. Sociologists must even be teamed up to collaborate in the work to tackle the problems. Insisting on the guiding ideology that scientific and technical work should be geared to the economy and organizing various forces to overcome technical problems in the socialist four modernizations will propel science in China to greater achievements.

12553
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LU JIAXI ON NEED TO TRAIN QUALIFIED PERSONNEL

Beijing ZIRAN BIANZHENGFA TONGXUN [JOURNAL OF DIALECTICS OF NATURE] in Chinese No 1, 10 Feb 84 pp 1-2

[Article by Lu Jiaxi [1687 0857 6932]: "On the Strategic Idea of the Development of the Chinese Academy of Sciences"]

[Text] Since the 3d Plenary Session of the 11th Party Central Committee, because the party Central Committee and State Council have formulated a series of important decisions, especially the grand objective put forth at the 12th Party Congress of realizing the quadrupling of the annual industrial and agricultural output value by the end of this century, the party and country have put new and greater demands on us. Judging by the trend of world developments, the "new industrial revolution" may lead to a new leap in social productive forces. We have to study this question and make adequate preparations. Since our implementation of the policy of opening to the outside world, objectively, we have been placed in the position of competing with advanced international scientific and technological levels and this requires us to make overall arrangements from an even higher starting point. Faced with these new demands and challenges, we must not miss the opportunity to study our strategy for development and plan the academy's scientific research and other kinds of work. Only thus can the academy be worthy of the trust of the party and country and the people's hope.

Now is the time for a study of our academy's strategy for development. During the period of the 12th Party Congress, Comrade Hu Yaobang, representing the party Central Committee, reiterated that the modernization of science and technology is the key to realizing the four modernizations. The 12th Party Congress has also clearly pointed out that education and science is one of the key points in the three strategies. Last year, Comrade Zhao Ziyang, at the National Science and Technology Awards Conference, presented an important report on "A Strategic Problem in the Rejuvenation of the Economy," and explained the strategic idea that "the rejuvenation of the economy must depend on scientific and technological advances, and scientific and technological work must be geared to the needs of economic construction." The spirit of these talks of leading comrades in the party Central Committee and State Council points to the direction in determining our academy's strategy. Moreover, the party Central Committee has decided to use 2 years' time to formulate a 15-year development plan for 1986-2000. This will enable us to study the academy's strategy based on serious investigation and study.

The weakness of the academy's current scientific research work is its "looseness." Although there is the potential advantage of many disciplines and arms (contingents), but because of a lack of strong organization, the real superiority has yet to be manifested. Of course, there are many reasons for this: there are policy and management level problems. But we should point out strongly that the most important reason is that a clear strategic objective has not been formulated. Every crucial and important technical problem in the national economy or build-up of national defense is a comprehensive question, and breakthroughs in important problems in scientific and technical developments also often require the close coordination of various professional personnel. Therefore, whether it is based on the needs of the development of the national economy or science and technology, we must, from strategic heights, strengthen comprehensive study.

Our strategic idea should be: "Form a fist and hit left and right." This is an analogy with two meanings. The first is that, in order to produce such a contingent and possess such capability, our academy can, on the one hand, in accordance with scientific and technological developments, produce our own unique scientific research results, open up new research spheres and newly developed technology and raise our scientific level; on the other hand, in accordance with the needs of the national economy and build-up of national defense, we can fully develop the role of the potential of science and technology to solve important crucial and comprehensive scientific and technical problems, thereby promoting the development of production. In the 1950's and 1960's, the scientific research forces of our academy and departments concerned have together contributed to developing the science and technology of computers, semiconductors and atomic energy and to the promotion of the establishment of related industries. At the time of the country's needs, a group of scientists threw themselves into the research and manufacturing of atomic and hydrogen bombs and made outstanding contributions. This example indicates that for a scientist with standards, his mark is his research ability. A physicist can use his knowledge of physics to study biological and chemical problems and promote the development of these subjects; those in theoretical studies can also organize and direct experimental scientific research; those in scientific research can also be transformed into specialists in engineering technology. I believe that we can make efforts in this direction beginning with the training of qualified personnel. The second meaning is that, based on the needs of the development of the national economy and build-up of national defense, we should consider comprehensively the trend of scientific and technological development and the academy's advantage and form various fists in the sphere of research. This is also very important in solving the problem of "looseness" in the academy. Here, we must strongly emphasize that the fist that we speak of is still one that can engage in high-level scientific research and can also resolve scientific and technological problems emerging from practice. For instance, the newly developed biotechnology research cannot be separated from such basic research work as molecular biology; it is only because of breakthroughs in molecular biology that new biotechnology has developed and from now on, developments in biotechnology still need nourishment from such research work as molecular biology. In the development of modern technology, the boundary between science and technology is not as clearly defined and the development of new technology will be

increasingly dependent on science. If we see only the aspect that biotechnology can develop new industries and obtain greater economic results and neglect the scientific research on which it depends, then we may remain at the level of imitation from now on. There have been such lessons in history.

To form such a fist requires long-term efforts. It needs a process and cannot be divorced from the academy's reality. A journey of a thousand li is started by taking the first step. We should have a goal to strive for and in a down-to-earth style start from reality. At present, based on the country's needs and capabilities, we should propose the spheres where fists can be formed. We should respect history and current conditions, adjust our policy so that everyone can work according to his ability and bring into full play the initiative of various kinds of research personnel to make the necessary contributions. As for planning, we should make long-term considerations and need to work hard at nurturing qualified personnel and raising the scientific level.

12380
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FANG YI ON BROADENING ROLE OF SCIENCE, TECHNOLOGY IN ECONOMIC CONSTRUCTION

Beijing JINGJI RIBAO in Chinese 24 Jan 84 p 1

[Article by Fang Yi [2455 3015], state councilor and minister in charge of the State Science and Technology Commission: "Three Expectations for Science and Technology Work"]

[Text] The people of our country stride into 1984 feeling triumphantly joyful. In the new year, under the leadership of the party Central Committee, the people will continue to exert efforts, centered on economic construction to take further steps to usher in a new phase, and strive for new victories. How does the science and technology front carry out this strategic policy of modernization that says "Economic construction must rely on science and technology, and science and technology must serve economic construction" and take further steps to usher in a new phase, and make new contributions to construction and modernization? Regarding this question, I put forward the following three expectations:

One is the hope that science and technology will play a much broader role in the macroeconomic policy. Contemporary science and technology is important not only because it can solve concrete technical problems in production and open up new industrial fields, but also because it can provide a scientific basis for macroeconomic policy. However, for a long time, the role of the latter area has been seriously neglected. This is one important reason why in the past mistakes have been made in macroeconomic policy. In the past few years, the situation has taken a turn for the better, and science and technology have begun to play a role in some macroeconomic policy. But it must be emphasized that at present, stress is being placed on "hard" technology, with emphasis on equipment and technology, and the neglect of "soft" technology including the role of science and technology in macroeconomic policies is still serious. Consequently, some major construction projects are begun rashly without scientific verification. This situation must arouse our highest concern and we must adopt measures for rapid change. Experience has shown that to change this type of situation, merely relying on the initiative of science and technology or economics will never be enough; we must make efforts in both areas. Experience has also shown that while raising the level of knowledge, we must also give guarantees through the system, through policy and through legislation.

Second is the expectation of taking further steps to promote the close connection between scientific research and production. The insufficient integration of scientific research with production even to the point of becoming separated from each other is a result of corrupt practices in both the system of science and technology and the economic system. If this problem is not solved at its roots, economic development is impossible. In the past few years, many departments and units have taken some heartening steps to realize the integration of scientific research and production, creating a number of effective forms of integration, and accumulating a lot of experience. The problem now, from the standpoint of science and technology, is primarily to alter uneven development, and enable the troops on five sides of the science and technology front, from those possessing knowledge to those taking real action, to make science and technology work serve economic construction, and place chief importance on service to economic construction. From the standpoint of economics, the priority is to raise the level of conscious reliance on science and technology and increasingly develop and use the inherent vitality of new technology. For this we must carry out a thoroughgoing reform of both the science and technology system and the economic system and open up new ways to combine science and technology with the economy. No reform is tantamount to deciding there is no way out. Reform is a kind of exploration and bringing forth of new ideas. We cannot indiscriminately imitate any ready-made pattern. We must promptly sum up our recent experience on reform to enable the integration of science and technology and the economy to develop along a correct course without interruption, from the preliminary stage to the highest stage, creating even more and better forms of linkage, bringing together even more experience.

Third is the expectation that great efforts will be made to promote the mobility of talented people in science and technology. For a long time, the administrative employment of talented people in science and technology has been irrational: on one hand, in quite a few scientific research units and schools of higher learning talent is overabundant, wasted and there is no scope to exercise one's abilities. On the other hand, in the vast majority of medium- and small-sized cities, rural villages and medium- and small-sized enterprises, there is a serious lack of scientific and technical talent, and the situation of having the place but not the talent exists. On one hand, a number of scientific and technical results often are not popularized, to the point that they may just as well be gifts, exhibition products or samples; and on the other hand there are many problems concerning production technology which urgently need to be solved, yet often there is no one to study these problems. Actually, the number of science and technology personnel in our nation is few, yet the existence of such irrational phenomena in our country further restricts the science and technology personnel now available from bringing their roles fully into play. There must be a systematic flow of talent from the scientific research units and schools of higher learning to production departments, and from the large cities to the medium- and small-sized cities and rural townships, and from the coastal areas to the outlying districts. We should encourage and recommend that science and technology personnel be transferred to production departments together with their respective research results, and equipment and instruments to lead and guide the running of factories and set up workshops and assembly lines to enable their

research results to be quickly put to good use in the production process. It should be recognized that to promote the mobility of scientific and technological talent is a major strategic measure in science and technology work to implement the strategic policy of modernization.

In 1978 the opening of the national science convention welcomed the springtime of science. Six years later, in the springtime of science today, life is even more flourishing and prosperous. We wish for even more gorgeous and colorful flowers to bloom for our science and technology work in the new year, reaping an even more abundant harvest of practical economic results.

12643
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PRIMARY TASKS OF INDUSTRIAL RESEARCH INSTITUTES DISCUSSED

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 1, 1984 pp 19-22

[Article by Gan Shijun [3927 1597 0193] of the Planning Bureau of the State Scientific and Technological Commission: "Some Problems in the Management of Industrial Research Institutes"]

[Text] Industrial research institutes are of considerable importance in the scientific research force in China. From the tasks they undertake and their position in scientific and technical work, they can generally be industrial applied research institutes (industrial research institutes for short).

The author recently attended a seminar on the "management of industrial applied and service research institutes in developing nations." This paper discusses some preliminary views based on the problems discussed at the meeting, in conjunction with actual conditions in China.

I. Role and Position of Industrial Research Institutes

If the entire scientific research process to bring a scientific concept to production is divided into eight levels, including scientific conceptualization, theoretical exploration, basic technological research, testing of principle, applied technological research, applied model development, pilot testing and production, the primary duties of industrial research institutes are focused on the latter four levels. This type of research institute directly serves the national economy. They should be the technological development department in the development of the national economy.

Therefore, the topics selected by industrial research institutes should be concentrated on the emergence of new technologies which have been or may be proven to be practical. Through research and development, these new technologies are to be applied to relevant sectors in the national economy. In other words, the major task of industrial research institutes is to help existing industries with new technologies already in existence in the world, instead of finding new technological directions and establishing new industries. In this sense, industrial research institutes are mainly concerned with technology transfer.

The entire process of technology transfer can be divided into three stages--selection, adaptation and absorption. Selection is the premise of transfer, absorption is the goal and adaptation of the technology is the essence.

Technology transfer (from foreign countries to China) can take place by either of the following two methods: the first method is to directly transfer a foreign technology to China. The second method is to transfer a foreign technology which has yet to be commercialized through our own development in China. These two types of technology transfer can be called the "import type" and "development type."

Transfer will result in some overlapping. Some technological overlap is necessary. However, it should be controlled to benefit the smoothness of the transfer, and to insure that the economics and time are reasonable.

The "development type" of technology transfer should insure that the degree of foreign and domestic technology overlap is moderate. When the overlap is too much, it wastes a lot of time, manpower and money to repeat a proven technology. Generally it is not suitable to adopt a "development type" of technology transfer for a commercialized foreign technology.

To a certain extent, the "import type" of transfer is to reproduce a proven foreign technology to make the most of its economical benefits as soon as possible. Of course, the degree of overlap is high. However, the overlap should not reach 100 percent; we must pay serious attention to the "adaptability" of technology.

"Adaptation" includes two aspects: One is the modification of the links in the technology, techniques and process which are not suited for China (technology suits the conditions) through the economical analysis and evaluation of the technology introduced. Two is to change the conditions in China to suit the technological requirements (conditions suit the technology). The adaptation process includes many stages, which primarily consist of:

1. Evaluating the design of imported technology and modifying it to meet the conditions in China; such as market preference, climate, pricing and maintenance level.

2. Matching the production technology with the technical level of the workers and the availability of raw material and equipment. Or when possible to train workers, improving the level of components and devices and renewal of equipment to satisfy the requirements of the imported technology.

3. Fabricating original model products and continuously testing and improving these products until they satisfy the need in China; then, commercial production will begin.

Japan pays serious attention to technology transfer and adaptation. In the past 20 years, they spent $10 billion to purchase many applicable technologies from all over the world. They spent seven times the funds on adaptation studies, resulting in the great development of the Japanese economy.

Generally speaking, the two aspects of adaptation mentioned above, i.e. "technology suits the conditions" and "conditions suit the technology," will discount the benefit ratio of the imported technology as compared with that in the parent country. Let us call it the "adaptation index." If the index of "technology meeting conditions" for a certain technology is 0.95 and the index of "conditions meeting technology" is also 0.95, then the total adaptation index is 0.95 x 0.95 = 0.9. We can expect that this technology will reach 90 percent of the benefit in China as compared with that in the parent country. If our adaptation research is continuously improved. this index will become higher and higher. When it reaches 100 percent, we consider this imported technology to be totally "nationalized." The adaptation also reaches a turning point, i.e. it begins to exceed the current level abroad and has the ability to compete.

The adaptation process cannot last too long, usually several months to 1 or 2 years. Otherwise, the value of the imported technology will be lost.

As mentioned before, there is the important link of technology selection before adaptation in the technology transfer process. In the vast number of technologies, which ones should be transplanted? Where should they be brought from? How should they be transferred? Should the "development type" or "import type" be used? What is a good degree of technological overlap between China and foreign countries? All these problems must be conscientiously calculated and evaluated, and careful technological economics analysis and preliminary studies in some cases.

From the above analysis one can see that the process of technological adaptation and selection includes a great deal of research. Only when these problems are resolved, can technology transfer be effective. This should be the major duty of industrial research institutes in China.

In fact, most of the research subjects underway at industrial research institutes in China belong to the technology transfer type. However, the proportion of the "development type" is too high. The degree of technology overlap is seldom analyzed seriously. In some units, too much money is spent on exploratory projects with very small degree of overlap. Some are developing technologies already commercialized abroad. A general phenomenon is that there is not enough emphasis on the study of adaptability. This should be rapidly changed.

II. Organization and Management of Industrial Research Institutes

In economically developed countries, most of the industrial research institutes are managed by private corporations. Therefore, industrial research institutes are more closely related to the economy. Experience has proven that excessive administrative interference from the government and "institutionalization" of industrial research institutes do not benefit their effectiveness.

China is a socialist public ownership country. Research institutes are actually operated by the state. How to develop the advantages of socialism

and overcome existing shortcomings are important questions facing industrial research institutes in China. As a preliminary discussion, I propose these views.

1. Expand the Independence of Research Institutes and Through Contracts Make the Transition to Fiscal Autonomy

China is a nation with a planned economy. Research institutes are responsible for helping to resolve the nation's major scientific and technical problems. The long-range plans, short-term plans and key projects of the country clearly point the direction of studies at research institutes, which is a favorable condition for research institutes.

However, under the conditions in China, the management of research institutes should still have considerable independence, including the direction of the institute, selection of subjects, and hiring and turnover of personnel. The opinion of the research institute should be heard regarding these major problems and it should be allowed to have considerable policy making power. A technical research institute must not become an agency of the scientific and technological bureau of a ministry. A research institute cannot be "institutionalized." The government should not totally rely on administrative means to control this type of research institute. It should be realized primarily through five means, including review of the direction of the research institute, naming the major responsible personnel, evaluation of the work of the institute, financial funding and appraisal of major contract items. The latter three items are routine management. The evaluation of research institutes is especially important. The evaluation should include: the scientific research and other work performed by the research institute, the director, deputy directors and responsible personnel of major scientific research efforts of the research institute, and the financial status of the research institute. A system should be established to perform the evaluation once or several times a year. It will serve as the basis to determine the support, adjustment and funding of the research institute.

2. Gradually Break Down the "Departmental Ownership System" To Form a Technical Research System Classified by Profession

Overlapping facilities of industrial research institutes in China is serious; A considerable amount of research work is not gradually improved in a serial form. Instead, it is repeated at a low level parallelly. One of the major reasons for this situation is the "departmental ownership system." A typical thought reflecting this phenomenon is "to be fed by Department x is to work for Department x," which does not agree with the rules of technology.

Any research institute naturally should have its own major professional direction. However, the professional direction of a research unit is not equivalent to the branching of government organizations by profession. A research institute should serve the entire national economy with its own specialty, i.e. the specialization may be narrow, but service should be wide.

The major management methods of research institutes in China is to operate and manage the institutes by departments. But, it may not be the best way. However, to change this situation involves a reform of the entire scientific research system of the nation, which is not possible to resolve in the near future. We have given thought to whether it is possible to establish a management committee of the same profession across a number of departments in some large industrial research institutes under the leadership of various ministries. The committee may be formed of experts in the specific profession, leaders in the major industries served by the research institute and representatives of the government (but not acting as the responsible personnel on the committee). The members of the committee are working part-time to discuss and determine major problems such as the direction of the institute periodically.

A research institute will mainly undertake the research duties of a specific department. However, it may also accept work from other departments on a contractual basis.

A highly specialized industrial research institute with a narrow service area may be operated by a large enterprise. However, they should be encouraged to serve other trades with their own specialties.

3. Operating Fewer Comprehensive Multidisciplinary Research Institutes and as far as Possible Enable Research Institutes To Specialize

The situation in the world proves that a comprehensive institute is generally difficult to operate and manage. The investment and results are out of proportion (of course, there are some good examples). The future direction should be operating more medium and small specialized research institutes. Furthermore, they should be combined flexibly based on the need to tackle key problems, through the coordination of the departments or the state.

4. Perfecting the Command System in Research Institutes

The most important thing in the management of the affairs of a research institute is to select a qualified director. Furthermore, the director is given full authority regarding the hiring and firing, promotion and demotion, rewarding and punishing of the cadres. This is a key problem in the command system of a research institute.

In the well-managed large industrial research institutes abroad, there are usually two committees under the director: the advisory committee and project evaluation and review committee. The former is a group of high-level experts acting as advisors, and the latter is formed by a number of practically experienced people. These two committees are directly responsible to the director.

In a research institute, it is not appropriate to practice the principal engineer system because the director and the professional deputy director are experts in the field under a normal situation.

Generally, a research institute may have several professional deputy directors (separately connected with each research office) and an administrative deputy director.

The establishment of "project groups" are feasible. Each person in every special field belongs to a relatively fixed professional office. However, one also belongs to a temporary project group--i.e. a multidisciplinary, multiprofessional group formed based on specific tasks. The director has the authority to transfer professional people to form such groups. Once the duties are accomplished, they will return to their original research offices.

The research office level has the duty to establish and perfect specialty laboratories. However, independence and permanency should not be overly stressed. The basic working unit of a research institute is a project group.

5. Using Various Measures To Reinforce Contact With Factories, Business and Society

(a) The director and high level research personnel should establish an investigatory study and visiting system to grasp the first-hand information on demand for the technology of the institute from the factories, business and society. Furthermore, the accomplishments of the institute should be "peddled."

(b) An "open house" day should be held, i.e. to open the gate of the research institute periodically and invite related factories, business and potential users. The research institute will exhibit its own accomplishments, set up an information desk to answer the problems raised in various areas on the spot, and open up discussion.

(c) It should prepare brochures to introduce the special facilities, technical capability, equipment and instruments and research accomplishments of the institute to be distributed to the relevant organizations. Or, radio, newspaper and television should be used to advertise the institute.

6. Strengthen the Technical Information Work and Establish a Patent System

In addition to the usual technical information work, a large-scale industrial research institute should have a group to scan magazines, newsletters, publications, advertisements and samples, to report technical development trends and to provide references for the leadership and professionals.

Research institutes with the conditions should establish permanent connections with corresponding research organizations abroad to exchange information in time.

Patents, licenses and technical know-how are the primary "products" of industrial research institutes. The business in this area should be familiar. Special management personnel should be trained. A patent system should be established.

The party Central Committee set the magnificent objective of quadrupling the Chinese gross national product by the end of this century, and indicated that half of it would have to be realized by relying on technological advancements. The technological advancements mentioned here primarily involve the applications of effective technologies used abroad in the 1970's and early 1980's to the Chinese economy. Therefore, a large-scale technology transfer becomes an important task facing the current work in economy and science and technology. In this great struggle for the realization of the four modernizations, industrial applied research institutes in China should undertake this difficult duty. To execute the reform in order to satisfy the need is what a research institute should do at the present moment.

12553
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BUREAU TO ADMINISTER SCIENCE, TECHNOLOGY CADRES

HK160507 Kunming Yunnan Provincial Service in Mandarin 1100 GMT 15 Aug 84

[Text] In order to administer scientific and technological cadres in a unified way, to employ them in a rational manner, and to further the reform in the administrative system of scientific and technological cadres, the province has decided to set up a scientific and technological cadre administrative bureau as an organ under the provincial scientific committee.

The principal tasks of the provincial scientific and technological cadre administrative bureau are defined as follows:

1. To assist the provincial organizational department in implementing the party's guideline and policies on scientific and technological personnel.

2. To coordinate the assessment, classification, and promotion of scientific and technological personnel in cooperation with the departments concerned.

3. To deploy scientific and technological personnel in accordance with the needs of the national economy so as to ensure the completion of key projects and special projects tackling key technical problems, to select talented scientists and technologists, to recruit scientific and technological personnel who remain idle, as through self-study, to reassign to suitable jobs those who have long been working in positions irrelevant to their specialities, and to recruit in a planned way scientific and technological personnel from other provinces and from abroad.

4. To draw up, in cooperation with the departments concerned, plans for the training and employment of scientific and technological personnel and plans for refresher training, to organize training courses for scientific and technological personnel, to select qualified candidates and send them to study abroad, and to assist those backbone scientific and technological cadres whose families live in rural areas in applying to transfer their family members' household registration from rural areas to urban areas.

Now the Yunnan Provincial Scientific and Technological Cadre Administrative Bureau has started operation.

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FANG YI ON MANAGEMENT OF SCIENTIFIC CADRES

OW181221 Beijing XINHUA Domestic Service in Chinese 1458 GMT 17 Jul 84

[By reporter Zhuo Peirong]

[Text] Beijing, 17 July (XINHUA)--Fang Yi, member of the Political Bureau of the CPC Central Committee and state councillor, said today that it requires courage to break with old conventions in reforming the management of scientific and technical cadres and that only with this attitude is it possible to create a new situation.

Speaking at the opening of a national forum on reform in the management of scientific and technical cadres on 17 July, Fang Yi discussed the question of how to reform the management of scientific and technical cadres so that each of them can bring his talents into full play. He said: The pressing problem at present is the interflow of talented personnel because immobility of talented personnel is like a pond of stagnant water which can lead to many maladies. Efforts to initiate interflow of talented personnel can spur reform in other fields. The present immobility of talented personnel has been caused by departments and units which think that they own the talented personnel. He called for further emancipating the mind and taking action to promote a rational flow of talented personnel. For example, they should be allowed to move around freely within a city, a county, or even a province. In doing so, new problems may emerge. However, from an overall point of view, flowing water is more advantageous and less disadvantageous than a pond of stagnant water. He urged departments in charge of scientific and technical cadres to learn from the successful experience in rural reform and to encourage efforts to seek ways of reform.

Fang Yi also discussed the question of how to further implement the policy toward intellectuals. He said: Quite a few comrades have not yet got rid of the trammels of "leftist" ideology and are reluctant to respect knowledge and intellectuals, which constitutes a grave obstacle to the reform of the scientific and technical system and the management of scientific and technical cadres. He expressed the hope that such an erroneous tendency would be eradicated.

He advised comrades in charge of scientific and technical cadres to become bosom friends of scientific and technical workers and understand their innermost thoughts. He said: a department in charge of scientific and technical

cadres is like a bridge between the party and scientific and technical personnel, truthfully reflecting their legitimate demands on the party and working for safeguarding their duties and rights.

The forum, which is scheduled to last 5 days, has been organized by the State Scientific and Technological Commission. Attending the forum are responsible persons of departments in charge of scientific and technical cadres from all 29 provinces, municipalities and autonomous regions; from Chongqing and Wuhan, two cities selected for experimenting in comprehensive reform; and from all departments and commissions of the party Central Committee and the State Council.

CSO: 4008/385

GUANGXI PROMULGATES REGULATIONS TO ENCOURAGE SCIENTIFIC WORK

HK300349 Nanning Guangxi Regional Service in Mandarin 1130 GMT 28 Jul 84

[Text] In order to strive to develop science and technology in our region and to put an end to our region's economic backwardness as soon as possible, not long ago the Autonomous Regional People's Government promulgated 10 regulations concerning the reform of scientific and technological work.

All localities and departments, the regulations emphasize, should consider the development of science and technology to be the means by which the national economy is to be developed, dovetail scientific development with economic development, and try their best to combine the direction of and the priorities in scientific and technological development with economic development.

The leading bodies of the scientific research units, it is pointed out in the regulations, should be manned with those who are more revolutionary, younger in average age, better educated, and professionally more competent than those before. Directors of research institutes should be scientific or technical workers who are good at organizing and leading people and management, who have professional knowledge, and who are capable of creating new situations. The scientific research units should practice the system of letting the directors of scientific research institutes be in charge. The directors of scientific research institutes should be democratically recommended by the scientific and technical workers or openly recruited from among the applicants for the posts. And then, they are to be appointed by higher authorities for a term of 3 years. Their term of office can be extended. The directors of scientific research institutes are empowered by the higher authorities to decide on the personnel, finances, deployment of goods and materials, and scientific research plans of their own institutes. As for the surplus workers and those who are not suitable for scientific research, the scientific research units can make arrangements for them or let them find their own jobs.

In order to give play to the role of the scientific and technical workers, it is pointed out in the regulations that they can be allowed to hold other posts, assume contracted responsibilities for scientific and technological work, or do spare-time scientific or technological work in other units provided that they can do their own job well. The income goes to them in principle.

The scientific and technical workers should be encouraged to temporarily leave their posts without pay or to resign of their own accord in order to go to

backward areas, remote areas, or the mountainous areas to assume contracted responsibilities for scientific and technological work, develop science and technology in the mountain areas, transform the town and township enterprises, or develop commodity production in rural areas. Scientific and technical workers can be individually or collectively allowed to undertake scientific research projects, provide advisory services, or train people. As for those scientific or technical workers who have made important scientific or technological achievements and who have been given a considerable amount of academic or technical training, we can promote them by breaking the rule and confer professional titles on them regardless of seniority and their ages.

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HUBEI ACADEMY REFORMS SCIENTIFIC RESEARCH MANAGEMENT

HK270804 Wuhan Hubei Provincial Service in Mandarin 1100 GMT 25 Jul 84

[Text] The provincial Academy of Agricultural Science has boldly reformed the scientific research management system. It has begun the trial implementation of 10 reform measures since 1 July and thus has given play to the initiative of its scientific and technological workers and created a new situation in the academy. The major content of the 10 reform measures are: A system of the academy president being in charge of the whole academy has been implemented for the academy; a variety of forms of the contracted responsibility system has been implemented for its scientific research workers; a system of assigning responsibility for management through tenders has been in trial implementation for its management personnel; technological companies have been established in the academy and the institutes under it to undertake responsibility for supplying technology by contracts, provide technological advice and training and deal in scientific and technological research achievements; various forms of combination enterprises to carry out both scientific research and production have been set up; research units and individuals have been allowed to raise funds to carry out research of a developmental nature or to carry out experiments in production, and they are allowed to share half the profits according to the proportion of their investment; and after fulfilling the tasks assigned at their posts, the scientific and technological workers can be employed by other units to do concurrent jobs of teaching, scientific research and giving guidance in production and technology, and they are allowed to receive most of the remuneration paid to them by these units.

The 10 measures have added new vitality to research work throughout the academy. Recently, tenders have been publicly invited and accepted for seven research projects, including that of breeding fine cotton species, that related to new strains of late rice, and that of processing tea by machines, and contracts on them have been signed. Units including the Silkworm Diseases Research Institute and Pig Breeding Research Office have been changed from scientific research and production institutions into scientific research and production enterprises. They have begun to be responsible for their own expenditures independently and have handed over the funds allocated to them by the state to the institute as its scientific research funds.

CSO: 4008/385

GUIZHOU ESTABLISHES WORKERS TECHNOLOGICAL COOPERATION COMMITTEE

HK261540 Guiyang Guizhou Provinical Service in Mandarin 2300 GMT 25 Jul 84

[Text] The Guizhou Provincial Workers Technological Cooperation Committee was formally established yesterday [25 July]. Over the past few years our province's workers technological cooperation activities, aimed at promoting economic construction, have developed very greatly. Owing to the large number of achievements in technological cooperation, difficult technological problems in many enterprises have been solved and apparent economic results have been produced. As a result of the popularization of the long distance infrared heating technology [yuan hongwai jiare jishu], which is one of these achievements, some enterprises have been able to economize on electricity by 70 to 80 percent. Some 100 grassroots technological cooperation organizations and achievements have been established for technological cooperation between factories.

With a view toward carrying out the workers technological cooperation activities throughout the province even better, with the consent of the provincial CPC Committee and under the support of the provincial Federation of Trade Unions, some 140 representatives from the workers technological cooperation organizations in all places throughout the province held a meeting in Guiyang on 24 and 25 July. The meeting elected the Guizhou Provincial Workers Technological Cooperation Committee, which is composed of 56 committee members. At the inaugural rally of the Provincial Workers Technological Cooperation Committee, the collectives and individuals who have achieved outstanding results in technological cooperation activities over the past few years were commended and rewarded. Governor Wang Chaowen attended the rally to extend greetings and to speak.

CSO: 4008/385

IMPLEMENTATION OF RESPONSIBILITY SYSTEM FOR RESEARCH

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 1, 1984 pp 69-71

[Article by Na Baokui [6719 1405 7608] of Central Iron and Steel Research Institute, Ministry of Metallurgical Industry: "The Question of a Responsibility System in Scientific Research Institutes"]

[Text] Ever since various types of the responsibility system of linking planned output with renumeration were implemented in agricultural production, industrial and business systems also attempted all kinds of economic responsibility systems to combine responsibility, authority and benefit. The enthusiasm of employees was increased to a large extent, thus promoting development in production and management. This type of reform not only benefits the prosperity of the nation but also helps to improve the living standard of the people. It was widely welcomed and is gradually being improved, perfected and expanded.

This type of reform will affect scientific research units. Some people advocate that scientific research units should also implement an economic responsibility system. There are people advocating that research units should practice a scientific research responsibility system. During the past year, various methods were implemented due to difference in understanding. Based on the specific situation in this unit, various forms of the responsibility system were tried out. Some were near perfect and some were crude. However, they all have certain results and drawbacks, which is normal. Because it is something new, there is the process of practice - recognition - practice again - new understanding.

Based on an incomplete understanding, many scientific research units are implementing an economic responsibility system. For example, contracting systems are implemented in expenditures, conditions are guaranteed and research results are rewarded according to economic results. In some cases, a percentage of income from technical services and profits from newly manufactured products was taken as bonuses. By doing so, there are advantages and disadvantages. After an economic responsibility system was implemented in a scientific research unit, technical service and product fabrication became more active. A considerable number of technical personnel applied

scientific research results and their technical expertise to various areas of the national economy in order to promote the results and render technical services. This not only solved problems in production but also increased the income of the unit as well as the bonuses of individuals. A considerable number of technical people used research equipment for external processing and testing. They provided products and technologies to society and the profits were considerable. Not only was the scientific research fund increased, but also personal income was raised by working harder. However, under the present financial and management systems, there is no business department to handle bonuses or overall rewards in a scientific research unit. The overall reward is linked with the total salary, not related to the total income. Therefore, in the same research unit, there will be more bonus money with some direct income and fewer bonus money without any direct income. Because of their difficulties, key national projects are long-term. Economic results may not emerge in three to five years. Hence, few people are willing to do it. Although some basic research is very important to the development of a technology or product, however, no one would be interested because economic results cannot be directly calculated. Especially for comrades in technical support, living logistics and management, there are few successors in these areas at the present moment. It will be more difficult to reassure them. Therefore, the trend will be fewer projects and less people. It will be very difficult to organize any long range key projects.

Of course, we cannot neglect the effect of political ideology and adjustment in the distribution system. However, policy is the most powerful. Scientific research units not only must produce material achievements but also spiritual results. It is difficult to evaluate the economic results of some achievements in the short-term; it is also difficult to calculate the benefits in a longer period of time. For example, some researchers developed a "basic characteristic parallelogram analysis method" over many years which significantly simplified the analysis of single crystal high voltage electron diffraction patterns and increased the speed of analysis. It facilitated the use of a computer in the analysis and had a significant impact on material science research. However, such an achievement cannot be evaluated by its economic results. As another example, scientific research personnel successfully developed a new material for a certain military equipment or advanced weapon to solve the problem of going up into the sky or diving deep into the sea. Even the users can hardly describe the magnitude of the economic result. Therefore, the use of an economic responsibility system to manage a research institution cannot be done unilaterally. Furthermore, the creativity of a researcher cannot be encouraged simply by money. Science is very similar to the arts in this regard.

Some people advocate that scientific research units should implement a "scientific research responsibility system." However, the contents of this scientific research responsibility system have not yet been reported in detail to date. No relatively complete experience is available either. Therefore, I believe that the responsibility system in a scientific research unit is an important problem to be seriously investigated. It occupies the core position in reforming scientific research work.

I. Responsibilities of a Scientific Research Unit

In order to investigate the responsibility system of a scientific research unit, first we must clarify its responsibilities. The responsibilities are to produce results and talents. Achievements, of course, must be economically beneficial so that they can be converted into productivity immediately. In addition, achievements with academic values cannot be neglected. They may not possess any practical economic benefit, however, there may be a potential productivity situated at the intersection of science and technology. Often, they are breeding more important inventions or creations. A scientific research unit should also become a base to raise talented people, even high level personnel. It not only improves the thinking and practicing capabilities of the technical personnel involved in research to a new level but also should be able to deliver trained personnel in modern science and technology to factories and schools to engage in production and education. We even consider scientific research as an experience equivalent to academic experience, which is one of the markers of individual standard.

Under the premise of producing results and talents, scientific research units are also encouraged to increase income and cut down spending. When the funding from the state is difficult, a portion of the scientific research funding can be compensated by increasing the income. It may also be used to increase some collective benefits. A research unit must be evaluated by its contribution to society, instead of its own profitability. It also means that its macroscopic economic benefits, instead of microscopic economic benefits, should be considered. Otherwise, it may not be a true scientific research unit, but a production unit instead. Using economic methods to manage scientific research units may not coincide with the laws of scientific research because the responsibilities of a research unit are to produce results and talents, instead of output and profits. Therefore, a responsibility system must be tied to its responsibilities.

II. Responsibility System for Scientific Research Units

Various economic responsibility systems are being implemented in experimental units. Most of them use a "total spending responsibility and profit sharing" method. In reality, a large share of excess income goes to the state, a small share goes to the unit and a small fraction goes to individuals. Some units advocate that a percentage of excess income should be retained, a portion to be used as research funds, another part will be spent for collective benefits and the remaining in bonus. This method essentially links distribution to profits, but does not link results to talents. The bonus will be larger in research units with direct income, lesser bonus will be availble without any direct income. Very often, scientific research staff members receive lesser bonus than workers because the total bonus is fixed despite that it is drawn from excess income. Therefore, if we do not want to bring various units to the same level and impose an individual ceiling, only those who are working on income producing projects are qualified to receive a higher bonus. Otherwise, excess income cannot be assured. After economic responsibility systems were implemented, a number of departments in scientific research units gradually established their own independent bank accounts, checks were issued to purchase materials, which

were distributed to individuals instead of cash. Some units issued a suit made of a high quality material to each person as a uniform. Some units issued cooking oil to employees and included its cost in the expense as lubricating oil. Other units held collective field trips to resorts by the mountains and beaches. Because of the absence of direct income, many scientific researchers cannot receive such treatment. Hence, scientific research units began to "look toward money," which affects its work to a certain degree. Therefore, I believe that the implementation of an economic responsibility system in scientific research units cannot effectively promote the production of achievements and talents. It even may have a certain negative effect.

The responsibility system in a scientific research institution must reflect the characteristics of scientific research and should not simply adopt the methods used in agriculture, industry and business. Before a scientific research achievement is commercialized, it is difficult to suit an economic responsibility system to a scientific research unit. I believe that a scientific research unit should implement a scientific research responsibility system. The basic features of the scientific research responsibility system are (1) the potential and level to produce achievements and talents are the standard to judge and evaluate a scientific research unit, not its economic revenue. (2) The standards to judge and evaluate scientific research results are not limited to economic benefits. Its academic, practical and sociological values must be included. (3) The standards to judge and evaluate personnel training are not limited to the proportion trained. More importantly, the intelligence structure should be rationalized. (4) The distribution system in a scientific research unit should not be based on "percentage of excess income" and "more income more gain." Instead, it should be evaluated by a post responsibility system centered around scientific research. Bonuses should be changed to floating wages. Furthermore, review and promotion should be regular and systematic. (5) Scientific research units should possess socialist morality. The state should give specific responsibilities to scientific research units according to the aforementioned principles together with specific review methods. A scientific research unit should then distribute these responsibilities to various systems and individuals. When everyone performs his work well, the effective development and smooth completion of the tasks of the entire research unit can be assured. When a scientific research unit is successful in producing achievements and talents, the state should permit the department to promote some people and to receive floating wages. The proportion can be determined by the extent to which the scientific responsibility system is accomplished. After bonuses are converted to floating wages, the technical personnel will be promoted to consider the collective and long range benefits. Unified planning and comprehensive balancing are used to ensure the development of scientific research by creative thinking and fast pace, instead of economic relations within a research unit. Thus, the expense of floating wages is not necessarily higher than bonuses. However, its effect is long lasting, not temporary. The phenomenon of "working according to the pay" would be changed to the normal track of "paying according to the work."

III. Practicing Scientific Management and Strengthening Ideological Education.

At present, the management level in most scientific research units is low. Some do not have a clear direction and tasks. Some do not have a long-range plan. Annual plans lack studies and demonstrations of policies. Overlapping management organizations and low efficiency are common phenomena. In the past, it was difficult to do something. Now, the tendency is that nothing can be accomplished without money. In scientific research units "real money and phony money" circulate simultaneously. Many cadre and research personnel must deliver and pick up samples with checks. The procedures are very complicated. Researchers are in an abnormal "multiple thinking" state. Furthermore, some problems in research morality begin to emerge due to bonuses. Therefore, with respect to leading and managing a research unit, I believe that it is not only necessary to investigate "total spending responsibility and dividing percentage of excess income" but also more important to study the objective patterns of research management, implement scientific management methods, insist on socialist direction and strengthen political ideology.

The major contents of modern scientific management are systems, human resources and values, as well as the mutual interaction and overall motion of these three aspects. If only an economic method is used to manage scientific research, at most the values principle is partially applied. Moreover, frequently the economic value is emphasized which academic, practical and sociological values are neglected. Only when the principles of the system and that of humanism are included in management, it will be possible to carry forward the enthusiasm and creativity of people from an overall viewpoint. Currently, the projects are getting smaller in scientific research. Fewer people are involved. People are willing to work individually instead of through collaboration. The application and promotion of achievements are emphasized while preliminary research and reserve are neglected. We are used to the management of handicraft industries and are not aware of or good at starting from the overall system to make assignment arrangement by projections, to adjust direction by feedbacks and to realize the objectives by a matrix system. The phenomenon described above are all against the principles and methods of the system. In addition, the viewpoint of behavioral science should be used in conjunction with socialist principles to strengthen the political ideology of technical personnel in order to establish a communist scientific research morality. These problems cannot be resolved by "contracting" and "profit sharing." Finally, I want to explain that I do not deny the correlation between scientific research and economic results. I believe that the use of economic means to manage scientific research or to implement an economic responsibility system in a scientific research system does not necessarily coincide with the characteristics and scientific laws of research. We should seriously investigate the essence, contents and methods of the scientific research responsibility system, master the laws of scientific management and establish a management science with Chinese characteristics.

12553
CSO: 4008/155

REFORM MEASURES TO ACCELERATE PROGRESS OF SCIENCE, TECHNOLOGY

Shijiazhuang HEBEI RIBAO in Chinese 26 Apr 84 p 1

[Article by Li Naiyi [2621 0035 3015]: "Place Emphasis on Solving the Question of Scientific and Technological Work Lagging Behind the New Situation"]

[Text] Following closely the great political principle of gearing scientific and technological work to economic construction set forth by the 12th National Party Congress, the leading party group of the Provincial Scientific and Technological Commission has achieved preliminary results in measuring its thinking earnestly, in adopting vigorous measures of reform, and in positively seeking a solution to the question of our province's scientific and technological work lagging behind the new situation.

At a plenary session of the party members on 24 April the leading party group of the Provincial Scientific and Technological Commission proceeded along the following three major directions to measure the question of scientific and technological work lagging behind the development of the situation and failing to meet the needs of economic construction.

I. The open-door policy has not been implemented, make every effort to develop qualified personnel. By proceeding from the present situation of the existing 260,000 or more technicians of natural science, who make up only 0.49 percent of the total population in the entire province, the leading party group of the Provincial Scientific and Technological Commission has examined itself for not implementing an open-door policy and for basically not stepping forward to reform the policy on men of talents and on reasonable mobility, thus forfeiting the chance of winning a battle. For example, there are 600 colleges and universities and scientific research institutes in Beijing and Tianjin, but we have not made full use of our geographical advantage to introduce technology and qualified personnel and to initiate technological cooperation. Even the 10,000 scientific and technological personnel of 28 scientific research and designing units under the supervision of ministries that are stationed in our province have not been appropriately used to render services to Hebei. In addition, there are in foreign countries more than 600 experts and professors, who have relatives in Hebei, who hold in their hands the advanced technology of the 1970's and the 1980's, and who for the most part are willing to do something for their own hometowns, but the Provincial Scientific and Technological Commission has not made use of this advantage.

II. Facing the challenges of a technological revolution, the Provincial Scientific and Technological Commission is out of touch with reality, ill-informed, ineffective in leadership, and inefficient in an "advisor" to the Provincial CPC Committee and the Provincial Government. As an "advisor" to the Provincial Government in scientific and technological work, it ought to have viewed the situation as a whole, and it should have known its own jobs. Nevertheless, the leading party group of the Scientific and Technological Commission does not know much about the situation of the advanced technological level in the present-day world. It is ill-informed and incapable of grasping the new trends of scientific and technological developments at home and in foreign countries. It has not worked out an overall plan and an idea for development of science and technology compatible with the conditions of this province, by proceeding from a pledge to fulfill the party's general goal. In terms of work, it lays hold on the immediate present in disregard of the distant future, knowing only a part of the situation, but not the situation as a whole. It seldom hammers out a scientific research project that affects the entire economic situation, and sometimes it even comes up with projects of an unrealistic nature. From 1981 to 1983, 159 projects were planned inappropriately, thereby creating a loss and affecting the use of funds of 2.94 million yuan. For a long time, the Provincial Scientific and Technological Commission was interested only in obtaining achievements, but not in emphasizing work on the feedback of results. According to investigations conducted on 19 departments at the prefecture and municipality level, 8 departments under the direct provincial supervision, and 29 units at the grass-roots level, of the 1,650 categories of technological achievements attained from 1979 to 1982, only 25 percent were popularized and applied with better results, 40 percent applied slightly, and 35 percent not applied at all. No suggestions for an improvement have ever been set forth initiatively to solve the problems existing in technical transformation and in introduction of technology.

III. Tremendous changes have taken place in the situation of the rural areas since the Third Plenum of the 11th National Party Congress, but the technological and scientific work of our province has not tried hard to catch up. After the implementation of a system of responsibility for linking individual families with contracted work in the rural areas, the broad masses of the peasants have had an imperative need of learning from science and of using science to enhance production. The original system of rural science and technology can no longer adapt itself to developments of the situation. The ways and means of implementing a large-scale popularization and dissemination of science and technology in the rural areas, by relying on the enthusiasm of the broad masses of the peasants, by bringing into play the forces of the state, the collective, and the individuals, have obviously become an important problem of the Provincial Scientific and Technological Commission's reform of the scientific and technological work in the rural areas. Yet this has not aroused the Provincial Scientific and Technological Commission's adequate attention. Last year, 19 technological development centers and 208 technological service companies were established at the county level, 829 technological service companies were set up in villages (communes), research institutes and technological service companies were formed jointly by peasants in some areas. All that has been done to these new things is only a general summation and popularization of experiences,

but they have not been organized and implemented with profound enthusiasm. Therefore, as of today, they have not been pushed forward extensively in the entire province.

In the course of measuring itself, the leading party group of the Provincial Scientific and Technological Commission summed up the key factors of the aforementioned problems as follows: (1) There was no integration of theory with practice in lines and principles adopted since the Third Plenum of the 11th National Party Congress, nor was the realization of an overall goal and a general task linked up with one's concrete job to form one single entity. (2) There was no genuine emancipation from bondages of the "left"--being politically insensitive, ideologically conservative, obsequious only to party secretaries and superiors, not daring to make a reform, afraid of taking risks, of making mistakes, and of losing "official posts." (3) There was no escalation in conquest of bureaucracy, no improvement in penetrative study and investigation in a real sense, no enhancement in observation and understanding of human feelings and community circumstances, to a magnitude in which one took cognizance of implementation of the party's ideological line by starting all out from realities.

The leading party group of the Provincial Scientific and Technological Commission believes that checking things up is aimed at improving work, but not at making an attempt to pass through an ordeal. Therefore, at the time of measuring themselves, they have energetically carried into effect a reform of the scientific and technological system, making it adaptable to the new situation. First, shattered is the act of maintaining a purely government-run and sealed-up system of science and technology. In scientific research, dissemination of achievements, popularization of science, and technological services, the state and the collective and the individuals all come out simultaneously to mobilize the forces of the entire society in running science and technology. Second, shattered is the act of "eating rice out of a big common pot," which has been replaced by the implementation of a technological contract system that boosts the scientific and technological personnel's pressure, motivating power, and vitality. Third, shattered is the act of placing scientific and technological talents under "ownership of units," which has been replaced by a reasonable mobility to alter the situation of stifling control. Centering on these three issues, the Provincial Scientific and Technological Commission has conducted an investigation and study, proceeded from reality to shatter conventional rules and regulations impeding scientific and technological development, and worked out at separate dates in April eight draft programs--the 10-point suggestion on reform of the current scientific and technological work in the rural areas, the program for readjusting and consolidating the specialized research institutes at the province-prefecture-municipality level, the 6-point stipulation on reform of the system of specialized scientific research institutes, the suggestion on strengthening the management of the scientific and technological personnel, a number of measures for arousing the enthusiasm of the scientific and technological personnel, a number of measures for enhancing the progress of industrial technology, the tentative measures for reform of the planned management of science and technology, and the measures governing the reform of awards for and implementation of science and technology. Meanwhile, other measures of reform have also been adopted on the implementation of an open-door policy, the import of technology, the introduction of men of talents, and the realization of a level-to-level management of the scientific and technological programs.

12315
CSO: 4008/320

ESTABLISHMENT OF TECHNOLOGICAL CENTERS FOR VARIOUS TRADES URGED

Tasks, Organization Outlined

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 1, 1984 pp 35-39

[Article by Chen Xianhua [7115 7359 5478] of Tianjin Scientific Committee: "Accelerating the Establishment of Technological Development Centers for Various Trades"]

[Text] The speech "A Strategic Problem on Economic Vitalization" given by Comrade Zhao Ziyang at the National Science and Technology Awards Conference indicated that attention should be addressed to the rapid establishment of technological development centers for various trades. The number need not be large. However, they must be run well to be actually functional.

This paper provides some preliminary exploration into the problem of establishing local technological development centers for various trades.

Frankly, transforming research institutes of various trades into technological development centers does not refer to all the research institutes for natural sciences; it refers to those institutes conducting applied research and development. In particular, they are trade research institutes, including the research institutes of all industrial corporations and some institutes managed by bureaus.

I. Necessity of Establishing Technological Development Centers for Various Trades.

A. Establishing technological development centers for various trades is a strategic requirement for economic vitalization and giant development which relies on advances in science and technology. The Twelveth Party Conference listed the magnificent objective to be reached by the year 2000 in national economic development. It requires the various sectors in the Chinese national economy to solidly transfer to a new technological basis step by step in a planned way. It is a difficult task. In our current industrial enterprises, most of the equipment belongs to the fifties and sixties, some belong to the thirties and forties. The level of production technology is considerably out-dated. It will urgently rely on progress in science and technology to

change and improve the fundamental industrial level in China. It will require more applied research and development to replace old technology, old equipment, old material, old techniques, and old products [five olds] with new technology, new equipment, new materials, new techniques and new products [five news]. Industrial production tasks are arduous. Productivity will have to increase at a certain rate every year, and quality must also be improved. In some cases, it is necessary to work hard to produce high quality products. The technical strength of many plants, especially medium and small-scale enterprises is not adequate. It is difficult to realize the replacement of the "five olds" with the "five news" by their own strength. Therefore, it is necessary to accelerate the establishment of technological development centers for various trades, which should have a leading effect on the improvement of technological advances and economical results of different trades.

B. Establishment of technological development centers for various trades is required in reform of the scientific research system. The current research system cannot satisfy the needs of economic construction. Scientific and technological problems to be urgently resolved during economic construction cannot be immediately made known to the research units. Production units do not quite understand the results of research units. Research institutes of a trade and the businesses in the trade do not form a whole. Instead, they are separated into two units which are not mutually complementary. Based on our understanding, there are six inadequacies in the research institutes as reported by the related industrial departments, i.e. inadequacy in the consideration of product competitiveness in the market when planning research on new products, inadequacy in the consideration of technical transformation in enterprises, inadequacy in the consideration of the special features of the trade and area in order to take full advantage of them, inadequacy in the consideration of development of new generations of products, inadequacy in the consideration of economic results and inadequacy in the consideration of technological projection and market forecast. The relevant research institutes also reported six inadequacies concerning the industrial departments, i.e. lack of research topic, lack of talents, lack of research means, lack of funding support, lack of coordination and inadequacy in promoting research results. The results are: 1) the number of research results is on the low side. According to a survey done in 1982 on 65 industrial research institutes, there were 4,211 research personnel. On the average, each institute had 64.8 people. Between 1980 and 1981, 2,642 research projects were assigned. On the average, each institute handled 20 projects per year. The actual number of verified research projects in these 2 years was 341, accounting for 13 percent of the total assigned number. On the average, each institute did 2.6 projects per year. The number of results popularized in production in these 2 years was 240, accounting for 9.1 percent of the total planned research projects. Each institute averaged 1.8 projects per year. If an analysis is made by the number of results per person, it requires 25 research personnel, on the average, to evaluate one research result per year. The number of research results should be considered low. 2) Results from technical transformation are few. For example, energy conservation and water conservation are two key points in the economic construction of Tianjin. A survey of the subjects arranged at four units, i.e. institute of paper, institute of hand alloy,

institute of medical industry and institute of food and oil, there were only three projects related to energy and water conservation out of a total of 64, approximately 4.7 percent of the total. 3) A considerable number of research results were not popularized nor applied. Even for a unit such as the institute of textile industry, which popularizes and applies technological results frequently, out of the 55 verified research results made from 1978 to the end of June in 1983, seven projects were still not applied (approximately 12.6 percent). In addition, eight projects (about 14.5 percent) were extended to pilot testing in order to market some products. Therefore, it is necessary to change the situation of research and production being separated. We need to change the situation of the research institute being an affiliated organization of the superior administrative department so that it actually becomes a production technological development center serving society.

C. Establishment of technological development centers for various trades is required in order to introduce, digest and absorb advanced foreign technologies. It is essential to manufacture new products through self-reliance. However, the introduction, digestion and absorption of advanced foreign technologies which are suited to China will also be necessary. Of course, the goal is not to introduce, but to digest and absorb for our own use. Without digestion and absorption, the introduction of new technology is meaningless. As the open-door policy is further implemented and the needs of economic construction develop, the import of new technology and equipment from abroad will increase even more. It is, therefore, necessary to tighten the selection of items to be imported so that they will match and satisfy the developmental planning and technical transformation of industry. Furthermore, the imported technology and equipment must be digested and absorbed in time. Of course, the introduction, digestion and absorption of advanced applicable foreign technology is highly technical work, which requires dedicated manpower, materials, funding and time. Therefore, it is necessary to establish technological development centers for various trades to thoroughly plan and implement it step by step.

Hence, operating research institutes as technological development centers for various trades is an urgent and important task in current economic construction.

II. Tasks of Technological Development Centers for Various Trades

The duties of a research institute directly engaged in applied research and development involve three areas:

A. Tasks of a Development Center

(1) to draw up plans for technical transformation and technical improvement for the trade, and to identify the technical difficulties in the plans and organize to tackle these problems.

(2) to work on the development of new technology, new equipment, new materials, new techniques and new products in the trade, and to assist medium and small-scale enterprises in the development of new technology and products.

(3) to digest, absorb, popularize and improve imported advanced technology, thereby changing the production technology of the trade and forming a Chinese technological system.

(4) to train and provide personnel that can develop on their own the production technology needed by the trade.

(5) to conduct external technological exchange, including technical collaboration and the transfer of results.

B. Tasks of a Physico-chemical Testing Center

(1) to organize the preparation and modification of technical standards in the trade, and to advance products in the trade to reach world wide standards.

(2) to appraise samples of new products according to standards set by the state ,ministry and industry.

(3) to arbitrate and evaluate the quality of products in the trade.

(4) to analytically test imported machinery and samples and present reports with accurate data.

(5) to show convincing test data when there is dispute on export products.

C. Tasks of an Information Center

(1) to formulate technical policies to draw up a balanced development plan in science and technology, economy and society, to determine research projects and product development directions and to provide reference material and information for decision making centered on technical and economic progress made in the trade.

(2) to provide worldwide information on technical transformation, technology import and technical demonstration of the trade from aspects such as technical advancement, applicability and economics.

(3) to provide information for the application and popularization of scientific research results.

(4) to collect, build and study technical information and material on the products, technology, equipment and testing in the trade from all over the world, including the patent literature file.

(5) to edit and publish intelligence publications for the trade, and to organize a trade information network.

There is a dialectical relationship among the three major tasks--development, testing and information--of a research institute. The establishment and progress of a development center will show the direction of activities of the testing center and information center. The establishment and progress of a testing center and information center will provide assurance for the normal operation of the development center.

III. Conditions for Establishing Technological Development Centers for Various Trades.

To build research institutes into technological development centers requires the full support of manpower, materials and finding.

A. A number of high level technical personnel in the trade must be gathered as academic or technical leaders, and they should be allowed to fully develop their role.

B. The proportion of research personnel should be 60-70 percent of the total number of employees. More than one-third of the research personnel must be the backbone of scientific research.

C. A rational structure of specialization, intelligence, level and rank should be established to make up a ratio of senior : middle : junior research personnel as 1:6:10.

D. A complete set of accurate testing instruments and better research equipment are required.

E. In addition to providing operating expenses and research costs given by the superior organization, research funding paid for by supporting research units, and other income from the transfer of results of the institute itself, waiver of taxes on new products and technical services, a trade technological development fund should be established to pay for technological development.

F. The principal engineer of the trade should also be the actual leader of the development center. He has the authority to direct the technical capabilities of the entire trade.

IV. Forms of Technological Development Centers for Various Trades

Technological development centers for various trades should not adopt one particular form. Instead, various forms should be adopted according to the characteristics of various trades. Generally, there are three forms:

A. Generalized Technological Development Center. A so-called generalized center is in a highly specialized trade with a wide technical coverage, such as research institutes of welding, thermal treatment, laser and technical physics.

B. Specialized Technological Development Center. A so-called specialized center is in a highly specialized trade with a concentrated technological coverage, such as research institutes in paper making, timing devices, glass, leather, synthetic fiber, knitting, seasoning and furniture.

C. Comprehensive Technological Development Center. A so-called comprehensive center involves many disciplines across a number of trades, such as research institutes of light chemical, textile and biomedical engineering.

Of course, this division is merely an approximation. The bounds among the three centers may not be divided clearly for some research institutes. For example, laser technology may be used in areas as industry, communications, medicine and military. It can be categorized as a generalized technology. However, it involves optics, mechanics, electrotechnics and other subjects; it may also be called a comprehensive technology.

V. Measures to Operate Research Institues as Technological Development Centers, for Various Trades.

A. The reorganization of research institutes is basic development work. It is also the prerequisite and basis of operating research institutes as technological development centers for various trades. Through reorganization, first, a leading body must be organized and allocated based on the requirement to become more revolutionary, young, knowledgeable and specialized. Second, the direction and tasks of a research organization must be adjusted and clarified in order to better serve economic growth. Third, the research team must be adjusted and reorganized to form a rational staff structure based on needs. Fourth, the research management system must be reorganized and perfected to practice scientific management. Tianjin began reorganization of its local research institutes in the beginning of 1983, in approximately two stages. The first stage lasted until the end of September 1983, which primarily involved the adjustment and assignment of the leadership in each institute, identification of research tasks, preliminary adjustment of the team structure and establishment of the necessary rules and regulations in order to obtain significant results. The second stage began in October 1983 and will continue to the end of 1984. The leading group, research team and research management are required to meet the aforementioned standards. Technological development centers with their own special characteristics will be established.

B. The establishment of technological development centers for various trades and the reform of the system of industrial bureaus and corporations should proceed simultaneously. Based on the need and feasibility, each relevant industrial bureau and corporation will gradually be changed from an administrative management department to a business organization based on economic laws so that it not only will have an urgent need to get involved in new technology to improve economic results but also has the autonomy and authority to manage in order to adjust the manpower, materials and funds of the industries under its jurisdiction in applied research and development.

C. Open all Avenues for People of Talent. Under the premise of a unified political standard, we must insist on placing the level of knowledge as the number one priority in hiring. Methods such as advertising, rotating, moon lighting, borrowing and exchanging may be tried. The personnel and financial departments should facilitate the implementation of these recruiting methods. The administrative departments should also be responsible for transfering good technical personnel from other areas through reorganization and recruiting.

D. Set up a Fund for Production Technological Development. The sources of funds for production and technological development include: 1) funds for production technological development issued by higher authorities, 2) low interest

bank loans, 3) withdraw money from the equipment renewal fund to be handed over to bureaus and corporations, 4) withdraw money from fees for technology application, 5) withdraw money from new product fabrication and development funds set aside from the profit in the trade, 6) income of research institutes from the transfer of results and technical service*, 7) profits from new products. Taxes and profits of new products fabricated by the technological development center itself are exempt (this profit cannot be included in the total profit for bonus) or some profits remain with the research institute (30 percent) for a certain period as approved by the relevant department. Based on the principle of steady growth, the budget for items 1, 3, 4 and 5 should be increased gradually and not decreased or partially replaced due to increasing income of the business of the technological development center. In addition, all the research projects assigned by the responsible department (including industrial corporations) to the technological development center must be paid for. The research funding will be included in the technological development fund at the center.

E. Production technological development fund should be distributed based on the number of research personnel differentiated by senior, middle and junior levels. In the past and present, operating expenses are funded according to the number of people in an institute. It does not favor trimming administrative and managerial personnel and maintenance staff, offering an opportunity to bringing in non-technical personnel. Therefore, it is necessary to distinguish research personnel from non-technical personnel. Non-technical personnel should be paid at the standard of other business units. Production technological development funds are distributed according to the number of research people (in addition to research project costs). There will also be a difference for senior, middle and junior levels in order to encourage the institute to train and raise its own senior and middle level technical personnel.

F. Practice a responsibility system and floating wage system in scientific research. A technical responsibility contract system will be implemented for technical personnel to conduct applied and developmental research. Their research contributions to technical progress and economic results are used as the criteria in evaluation. The higher the contribution, the larger the reward will be. In a closely related manner, a floating wage system will be implemented under the premise of not overspending the total wages and resources to that the larger the contribution, the higher the salary becomes. In the reorganization of a research institute, the total payroll may be left to the management of the institute.

G. Two methods may be used to form a technological development center. One is to use an existing scientific research organization as the foundation to adjust and replenish. The other one is to use an existing research institution as the skeleton to absorb various attractive research laboratories in related

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*Before the responsible industrial bureaus and corporations are actually turned into business, before using an industrial corporation as a unified economic accounting unit, under the condition that research institutes and various industrial enterprises are still practicing independent accounting, the transfer of results from a research institute to a business in the same trade should be compensated. Fees should be collected for technical services rendered.

industries to jointly form a technological development center. In the former case, the research institute advises the business of various laboratories in the trade to form a technological development network using the institute as a development center. In the latter case, the research institute leads various industrial laboratories in the trade to jointly form a technological development center. In addition, according to the development plan of Tianjin, 10 new independent research institutes will be constructed in the period of the "Sixth Five-Year Plan." When these research institutes are being planned, they can proceed step by step with preference according to the requirement of the operation of trade technological development centers to the extent allowable by reality. When feasible, they can be directly established as technological development centers.

The establishment of trade technological development centers is a major event in the reform of the scientific and technological system. It is also a new task. We should concentrate on experimental units and typical cases should be used as a guide to gradually convert a considerable number of research institutes into technological development centers for various trades.

Relationship Between Development Center, Production

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 1, 1984 pp 40-41, 39

[Article by Wu Shimin [0702 0013 2404] of Science Technology Bureau in the Ministry of Chemical Industry: "Brief Discussion on Technological Development Centers for Various Trades"]

[Text] The present scientific research in China has many drawbacks facing economic development. The most significant two aspects are that the scientific and technological resources are overly dispersed and cannot concentrate into a "fist." Second, research is out of line with production to create a situation of "two layers of skin." This situation is not only seriously hinders the develpment of science and technology, but also does not coincide with the socialist planned economic system. It must be reformed. Premier Zhao Ziyang pointed out at the National Science and Technology Awards Conference that the following three guidelines must be emphasized before the scientific research system is totally overhauled: 1) establishing technological development centers for various trades, 2) establishing or reinforcing technological development centers for various trades, and 3) establishing contracts between research and production units through "coordinated process," "joint venture," experimental base, research contract, technical consulting, etc under the condition that the original structure and jurisdiction are not altered.

Therefore, all industrial departments are planning to establish technological development centers. In order to make sure this task proceed actively and steadily, it is necessary to investigate the following related problems.

I. Tasks of a Trade Technological Development Center

From the name, the basic task of a trade technological development center is to get involved in technological development. However, it is not totally the same as the technological development work done by existing research units. A trade technological development center focuses on the technological progress of the entire trade. Dispersed technical forces are organized through technological development work. The relationships among research, design, production and application should be set up to ensure the transfer of scientific technology into an actual productive force immediately. Therefore, the specific duties of a trade technological development center are:

A. to draw up a scientific and technological development plan, technical transformation plan and technology import plan for the entire trade, and to verify significant technical transformation and technology import projects.

B. to undertake and organize to tackle key problems, and to provide results of new technology, new products, new equipment and new materials.

C. to extend technical services to the entire trade, including technical consulting, technological and economic forecasts, promotion of technical results and training of personnel.

D. to evaluate, monitor and arbitrate product quality in the trade.

E. to collect and study both domestic and foreign technical information on the trade, and to organize and coordinate the work of various levels of intelligence stations to form a unified trade technical information network.

F. to formulate technical standards in the trade, to begin work in standardization, seriation and generalization and to promote products in the trade to reach international standards.

Obviously, a trade technological development center is also a trade technical service center, a quality monitoring center, an information exchange center and a standardization center.

II. Fundamental Conditions for Trade Technological Development Center.

As described above, a trade technological development center must undertake numerous tasks. In order to function effectively, it must possess the following fundamental conditions:

Professionalism. It must have the ideology to serve the entire trade. It should take the technological advancement of the entire trade, as the starting point and finishing point of various projects. Furthermore, it must have the ability and resources to organize, coordinate and guide the technical work in the trade.

Foresight. Science and technology should anticipate production development. A trade technological development center must be able to totally understand

the developments and trends of the trade throughout the world in order to conduct technological forecasts to provide the direction for future development. It should also be able to provide the necessary technological reserves for technical development.

Authority. It must have an obvious superiority in terms of talents, research equipment, measuring techniques and management level. It should have capabilities and resources to organize the tackling of key problems, transfer information and arbitrate quality.

III. Organizational Principles of a Trade Technological Development Center.

The establishment of technological development centers for various trades not only must take the tasks to be performed and fundamental conditions such as professionalism, foresight and authority into account, but also must satisfy the characteristics of industrial technological development.

The following diagram shows the general process in industrial technological development. [See following page.]

From the schematic diagram one can see that there are three special features in industrial technological development:

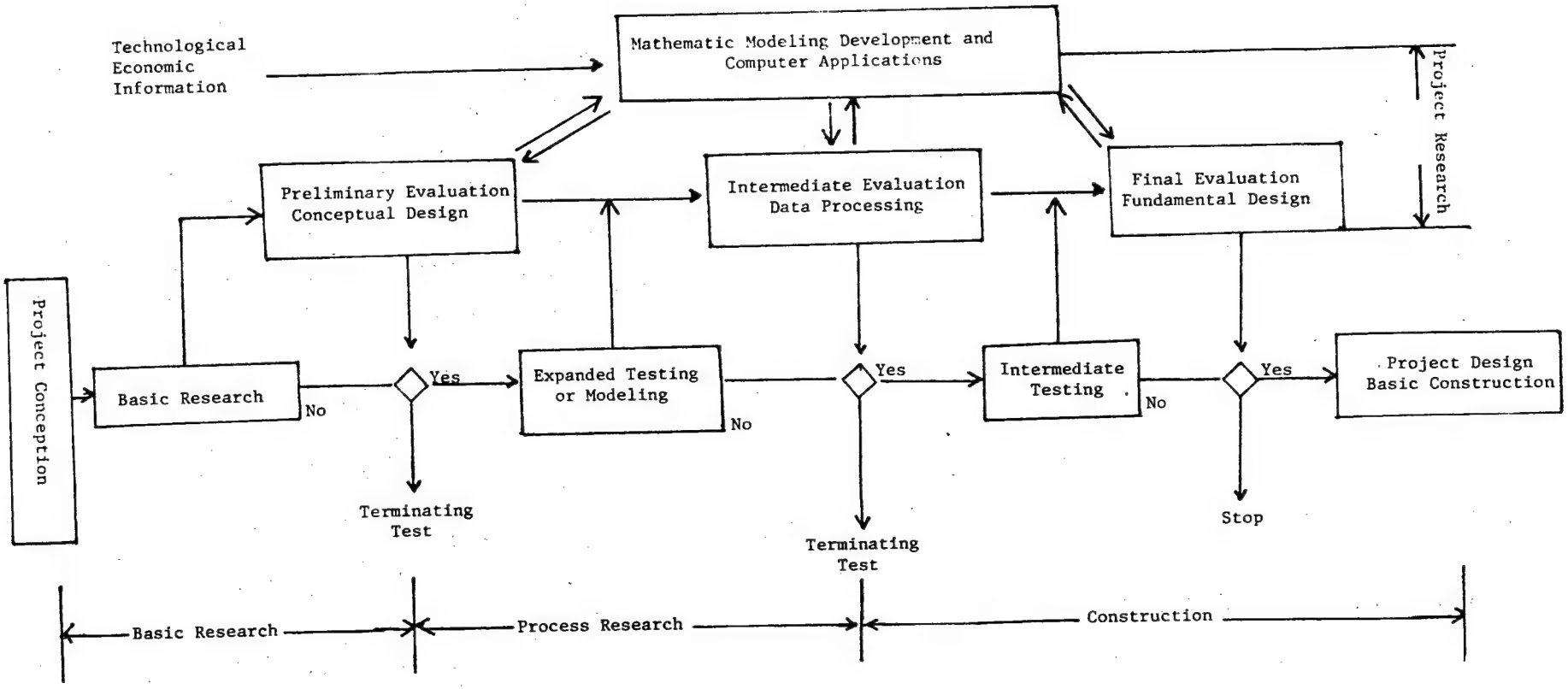
One is that an industrial technological development project is divided into three stages, applied basic research, process research and project research. Technological development work based on these three stages is essentially different from the "relaying" method of research and design in the past. The three stages in the development of a new technology are different, but overlap. It more accurately reflects the objective laws of research.

Second, the contents of research must not only include the study of process of techniques, equipment and materials, but also project studies such as economic evaluation, conceptual design and basic design. Beginning with topic selection, we must center on industrial application.

Third, project research should be the core of the entire research and development in terms of method. Project research is used to identify targets of the development work, to guide intermediate tests, to verify models of processes under development and to complete the final basic design.

According to the aforementioned special features in industrial technological development, the following rules should be followed in organizing technological development centers for various trades:

First, when organizing a trade technological development center, existing research units with relatively strong technical resources and publicly reorganized authority should be chosen as the basis for adjustment and reinforcement. Usually, it is not appropriate to build new ones. In addition to fixed research organizations, a technological development center should be able to absorb related research, information, institutions of higher learning and production units as its members based on the tasks the center is undertaking. The participating units may unite and form a management committee and board to plan, coordinate and lead the work in the development center.


Technological
Economic
Information
Mathematic Modeling Development and
Computer Applications
Project Research
Preliminary Evaluation
Conceptual Design
Intermediate Evaluation
Data Processing
Final Evaluation
Fundamental Design
Project Conception
Basic Research
No
Yes
Expanded Testing
or Modeling
No
Yes
Intermediate
Testing
No
Yes
Project Design
Basic Construction
Terminating
Test
Terminating
Test
Stop
Basic Research
Process Research
Construction

Second, because technological development work is to link the work of research and design with that of technique and engineering at various stages, it is necessary to consider the rational professional structure in personnel. Technical staff working on engineering studies should not be less than 30 percent. The technical personnel in the development center may be filled through advertisement, recommendation and visiting research positions in addition to adjusting technical staff in the trade.

Third, a trade technological development center belongs to a non-profit institution. The state should allocate part of the allowance from the technological development fund to set up technological development centers. It should be primarily used to fortify research techniques and to purchase software. The technological development plans for the centers should be included in the trade technical advancement plan, and funds should be allocated based on the plan. Development centers should collect capital through research contracts, compensation for technological transfer, patent applications, technical services and small batch research productions.

Fourth, the establishment of trade technological development centers must coincide with the reform and adjustment of the research system. It must be centrally planned through experimental points. Initially, the quantity should not be large. But, they must be run well. We may start from more developmental tasks. We should never just change the labels and names. National technological development centers should be reviewed and approved by the state.

Upgrading of Research Centers

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 1, 1984 pp 42-46, 50

[Article by Li Minquan [2621 3046 2938] of the Shanghai Institute of Electric Cable: "A Discussion on Transforming Research Institutes of Various Trades into Technological Development Centers Through Readjustment and Improvement"]

[Text] The Institute of Electrical Cable of the Ministry of Machine Building Industry was founded in 1957. It is an experimental research center of wire and cable products, materials, techniques and special equipment as well as a technological design institution for electrical wire and cable plants. For over 20 years, the institute has made certain contribution of how a trade research institute can be upgraded to a trade technological development center was given starting from the actual experience of the electrical cable institute.

I. Main Tasks of Technological Development Centers for Various Trades.

A trade technological development center is a new form of organization of a research institute, closely tied to a production enterprise in the same trade to gear science and technology to economic construction. It is different from a research institute because its work should be more than that of a research institute; it should contribute to the progress of production technology and raise economic results. It should be geared to the needs of the trade, and through plans, coordination, organization, research, development application

of new technology and technical transformation promote the technological development of the trade to satisfy the needs of the four modernizations.

A. Preparing Trade Technological Development Plans

There is an overall objective in the area of technology in China: "By the end of this century, advanced technology suited to the needs of China already widely adopted in economically developed countries in the seventies and early eighties will be popularized in plants, mines and business to create a technological system with Chinese characteristics.* The machine building industry is an equipment department for the national economy, which requires a "catching up" period. The trade technological development center should be taken into account the present status, characteristics, needs and potentials of the trade to seriously demonstrate and develop technological policies and equipment policies at various technological levels based on the overall objective. Furthermore, plans will be drawn up for the major research and design projects to tackle major problems concerning the quantity, quality and type of products, new materials and special equipment.

B. Provide Direction for Technical Transformation of the Trade, Tackle Key Technological Problems, Promote Progress in Technical Transformation.

Technical transformation is to pay attention to technological progresses to transform old technology, old equipment, old materials, old techniques and old products of old plants into new technology, new equipment, new materials, new techniques and new products based on advanced technology. Even new plants using advanced technology also require technical transformation continuously. Using the electrical cable trade as an example, China has several hundreds of production, special equipment and cable connector accessory plants for electrical wires and cables. The major production plants, when compared to those abroad, are mostly small or large comprehensive plants. There are only a few specialized production plants. There is a lack of continuous production line. Consequently, the productivity and labor output are lower than other countries. There is also a considerable difference in the number of types available. By simply looking at the total electrical wires and cables produced, which represents the productivity of the entire labor force, it is only one-sixth that in the U.S. in 1973. This shows that if a technological development center does not work hard to promote technical transformation in the trade, it will be impossible to accomplish the task of gearing scientific and technological work to the economy.

C. Strengthening Technological Reserve and Developing New Technology and Products.

When a trade technological development center is organizing or undertaking the task of tackling technological problems or technological development, it should follow the policy of "reforming the present generation, developing the new generation, studying the next generation." The center should emphasize the work on "studying the next generation" so that new technologies can be developed

*Zhao Ziyang: "A Strategic Problem in Economic Vitalization."

rapidly to obtain expected economic results. Only by developing and reserving new technologies continuously, the entire trade can be closely unified around the technological development center.

Development of new technologies and new products should also include the formulation of trade technological rules, arbitration of qualities and issuance of permits. Therefore, the establishment of a comprehensive test center is also one of its tasks. In the past, more emphasis was focused on products in short supply. The study on the common features in development was often neglected. Technological development centers should undertake long-term projects which can have a great economic impact.

II. Analysis of Present Status of Trade Research Institutes.

Current research institutes in various trades can only complete a portion of the tasks of technological development centers. The problems are that few research results are applied in production and new technologies are not developed in the form of a complete set. This is related to the system, organizational structure, planning, coordination, personnel and leadership.

A. Organizational Structure

In order to more rapidly promote progress in science and technology and to obtain the optimum socio-economic results, the organizational structure relating scientific technology to production must be perfected, such as the structure inside research institutes, the linkage between research institutes and production enterprises and the preparation and service departments needed to apply new technologies to production. Furthermore, the organizations and structure must be optimized.

(1) Each chain in the science-technology-production cycle is relatively independent, has its own special function, and develops according to its own pattern. Few scientific results are applied in production because plants do not pay sufficient attention to new technologies and the economic leverage is not fully developed, in addition an intermediate testing stage is missing between research design and production. Due to factors such as structure and funding, research institutes are not equipped to perform intermediate tests. Plants believe that research results should be put into batch production, especially after the implementation of compensated technological transfer. For this reason, the intermediate test link between research results and production must be resolved in the organizational structure.

(2) Research institutes must have a coordinated organizational structure. There are numerous electrical wire cable products, production is continuous and there is a wide range of technology involving a lot of special equipment. If we only conduct research on products and not carry out corresponding research on techniques and equipment, the accomplishments cannot be converted to productivity. When the cable institute was founded, a complete set of technical personnel was assigned to it and corresponding research offices were established. Practice has proven that if integration is good, research results will demonstrate their technological and economic results very soon. For example, in 1965 the institute was asked to develop some new electrical cables

for building railroads. This type of cable just became operational throughout the world in the sixties. The technical standard was high and time was urgent. Technical personnel in the areas of product research, special equipment design and research on plant techniques were organized to rapidly overcome to key technologies of insulation structure and wrapping of steel ribbon shielding under the support of relevant units. It only took 8 months to successfully develop the new Chinese version cable. Furthermore, a complete set of special equipment consisting of 22 pieces in seven types was designed. Simultaneously, the shop for the production of such electrical cable was also designed. After the product performance was tested and verified, it was put in industrial production to satisfy the needs of railroad construction.

It is also necessary to fully utilize the coordinated organizational structure in a research institute in management to effectively unite these organizations to work on the same objective in a certain period. Otherwise, the anticipated results cannot be reached.

(3) It is necessary to be involved in the service of new technological development. Whether a research subject and a technologically feasible approach can be applied to production and whether it will be enthusiastically adopted by production units depends on the service work of the new technology. Practice indicates that the focal point of service are in two areas.

One is raw materials. Improvement of electrical wires and cables relies on technological equipment and new raw materials. To promote research results in production, it is necessary to help to resolve the problem of raw materials to satisfy the technological requirements, to guarantee the quantity and to be economically viable. This does not seem to be a job in scientific research. Therefore, it is not noticed by some research personnel or institutions. In fact, this is the most important link to be missed by science and technology in serving the economy.

Two is to serve user units after a new technology is popularized and applied. The rate to promote a new technology in production, in addition to being affected by related factors in production, is also influenced by the users of these products. If the users are not familiar with the characteristics and special features of the new products, or the problems of such new products are not resolved in time, then progress in the promotion of this technology will be greatly delayed. The scope of service is very wide, such as inquiry on new products, technical training, instruction for installation and operation, product maintenance and introduction to electrical cable connection accessories. If service can be actively provided, the progress of this new technology will be promoted. For example, after the successful development and production of 110-330 KV high voltage oil filled electrical cable, the institute sent technical personnel to participate in the installation of these cables which was performed by the Ministry of Water Resources and Electric Power. Because of the absence of a continuous extrusion manufacturing equipment for the protective layer of the cable, oil leaked out from the lead layer in operation. The technical personnel of the cable institute also studied to resolve the repair technology for the oil leak. Moreover, they brought along raw materials for the repair work to various hydroelectric stations to repair the leaking cables to make these high voltage cables operate normally.

B. Planning and Coordination of Development in Science and Technology.

In the past, scientific and technological development plans, new products, new techniques, new equipment and material plans, test base plans, fundamental theory plans, technical personnel plans and technological introduction plans have been formulated. There were developmental plans for various trades as well as plans for the research institutes. Hence, it is possible to review the experience in drawing up these plans for research institutes based on the requirements of a technological development center.

(1) Overall balance and timely decision should be the major emphasis in planning. Planning of technological development centers for various trades is a basis of the national economic development policy. It must be prepared after a thorough investigative study and analysis of the actual status of the various trades based on the goal of national economic development and the requirements of other departments. Overall balance is very important to correlate the development within the trade as well as among other trades. Only based on an overall balance can a more accurate policy be made. These were the two weak lines in planning in the past. A comprehensive analysis is absent between users and the electrical cable trade, between the electrical cable trade and raw material suppliers and special equipment manufacturers, and in the electrical cable trade itself. The policies of higher authorities were also unclear and untimely. Many policies varied based on the intent of the leadership and the economic policy. Some items were only partially implemented so that anticipated technological and economic results could not be met.

It should be pointed out that clear responsibility should be assigned in the planning and decision making to establish a responsibility system. For example, a research institute should work hard on technological and economic forecast and analysis of overall balance. It should also be responsible for the anticipated technological and economic effect within a certain period after approval for implementation was obtained. The leading administrative organization should fully respect and utilize the results in research, analysis and inquiry by the technical staff during decision making and planning. It should not lead arbitrarily and set aside the plans.

(2) Information flow and coordination should be noticed in the execution of plans. Once the plan is approved and included in the national plans, it is feasible to identify the technical leading organization in order to ensure coordination among all execution installations. Usually, research institutes act as the leading organizations. In the past, leading organizations were not effective in administrative management (such as arrangement of the plan) and assurance of material resources (such as funding). However, they have been functional in the areas of information exchange and technological coordination. These information exchanges and technological coordinations, to a great extent, broke the barriers among departments.

C. Conditions to Guarantee the Promotion of Technological Progress

It is necessary to have appropriate conditions to guarantee the promotion of technological progress and to accomplish the major tasks of technological development centers for various trades.

(1) Progress in science and technology must first rely on scientific and technical personnel. There are problems in terms of number, age, knowledge and specialty concerning scientific and technical personnel.

Number of Scientific and Technical Personnel. The total number of employees in the research institute of a large business in Japan is 6-7 percent of the total number of employees of the organization. The number of technical staff in the cable institute is only 0.74 percent of the total number of employees in the electrical cable trade.

Ratio of Technical Staff to Total Employee in a Research Institute. There are 58, 63 and 64 percent in Italy, England and Japan, respectively. It is 46 percent in the cable institute.

Rate of Increase of Technical Staff. Recently, the rates are 9.6, 6.3, 7.1, 6.2 and 6 percent in USSR, USA, West Germany, Japan and France, respectively. In our institute, it decreased as compared to 10 years ago. Some new technical personnel were assigned starting in 1982.

Age of Scientific and Technical Personnel (not including the class of 1982). The average age of the technical staff is 49.5. More than one-third are over 46. Those who are under 35 are mostly new college graduates and junior technical personnel. The ratio of senior, middle and junior technical personnel is not rational. The proportion of senior engineers and junior technicians are too small. Middle level scientific and technical personnel account for 79 percent. Therefore, some technical assistance work was conducted by middle level people, which was a waste of talent. Furthermore, when people of the same level of intelligence are gathered together, some effort is consumed internally. Second, the proportion of personnel in specific fields is irrational. A research institute may have personnel excessively concentrated on the same special field, and lack talent in other special fields. The development of modern science requires the joint effort of many specialties and disciplines to tackle problems. A cable research institute in Europe has various experts in chemistry, physics, mathematics, metallurgy, polymers, communication and engineering control. The technical personnel with a background in basic sciences such as physics and mathematics account for one-third of the total staff, while there are only a few in the Shanghai Institute of Electrical Cable.

In order to manage the institute scientifically and economically, it is necessary to have personnel that understand modern scientific management, have economic knowledge and know how to administrate. We have few personnel in this category.

The development of technology is greatly affected by the lake of scientific and technical personnel, old age, and irrational structures in knowledge and specialty. Furthermore, the system of ownership by department and unit causes many research subjects to be duplicated, leading to waste.

A research institute, of course, can do very little to eliminate the shortcomings of the system of ownership by department and unit. However, if it

becomes a trade technological development center, it will be able to choose major topics to tackle after the technical development plan is drawn up. It will be able to organize the technical resources in the trade to solve a series of key technical problems from research to batch production.

(2) Progress in science and technology must be assured by funding. If a research institute is to become a technological development center, research funding is an important assurance.

In addition to salaries and ordinary expenses such as water, electricity and administrative costs, it is most important to assure that experimental bases can be equipped to meet the test requirements of the subjects under investigation so that major research projects can be conducted.

Funding the tackle problems should include the research stage, intermediate test (or pilot plant) stage and promotional production stage. The funding required for the latter two stages are higher, but they are also more effective. If the latter two stages are absent, research results are not of any applied value. Therefore, it is necessary to secure funding for major technical efforts realistically (according to information obtained from industrial countries abroad, if the cost to conduct research is one, the developmental cost is 10 and the production cost is as high as 100).

III. Considerations in Upgrading Research Institutes to Technological Development Centers for Various Trades.

Practice indicates that trade research institutes possess the conditions to become trade technological development centers in some aspects. However, reform, adjustment and reorganization must still be carried out to really meet the requirements.

A. Define the Tasks and Carry Out the Responsibility.

The task of a technological development center is clear from a broad viewpoint. However, if a responsibility system is to be established, we must still determine the detailed specific tasks in order to define the responsibility, authority and benefits of the center.

Duties such as planning trade development, recommending major trade technological policies, tackling major technical problems and designing key technical transformation in the trade should be scientifically proven by the technological development center through research and experimentation according to a rigorous schedule. Furthermore, it should be responsible for the technology, progress and economic results of the plans, recommendations and results presented.

A corresponding responsibility system should also be set up at the leading organization above the technological development centers, to be responsible for policy-making and providing the resources. If the same trade has two or more than two technological development centers, then the leading organization should divide their duties clearly. If it involves more than one department, it should be responsible for coordination.

The duties and responsibilities of plants and enterprises related to the technological development center must also be clarified. For example, enterprises must guarantee product quality and technological stability, and study and resolve technical problems in production. When capable, they can assume part of the developmental work. Major costly projects, however, should be organized centrally by the technological development center to avoid waste of manpower and money.

B. Upgrading, Establishing or Adjusting Corresponding Organizational Structures.

In order to be more effective than the present research institutes in terms of technological development and economic benefits, trade technological development centers must upgrade and adjust the corresponding organizational systems.

(1) A trade technological development center should be geared to its own trade, especially the vast number of medium and small enterprises. In addition to periodical exchange of technical data and information, they should frequently coordinate, discuss and decide on technological development problems such as the objectives, contents, scale and location of new technologies and the distribution of profits. Plants must also contact the center in regard to technical transformation. Therefore, the "trade office" should be strengthened in the organizational structure of the technological development center.

(2) A technological development center should have coordinated research and design capabilities and structure. It not only has the capability of product research but also has full time personnel for technological research and special equipment design. It is also necessary to establish an organization to design workshops in plants. By doing so, it is not only possible to organize major projects rapidly but also capable of obtaining real effects in technical transformation in plants after problems are tackled.

(3) A technological development center should emphasize service work. When necessary, a special service center should be set up. Or, it can be merged into the trade office as a special office. Its operating range is very wide, such as serving business with testing techniques and technical consultations, supporting departments using new technologies, providing technical guidance and personnel training, obtaining information feedback through close contact with the users and grasping first hand information on the direction of technological development in the trade.

C. Strengthen Technological Strength

The current technical personnel will be adjusted and fortified in order to rapidly build a complete hardworking technical team.

(1) Personnel suited for research, testing, design, trade service, information and research management will be arranged individually to join the adjusted organization. They will be assigned tasks to fully develop their expertise. Special talents in short supply may be hired.

(2) Before a system to circulate personnel is established, technological development centers should be allowed to have the authority to borrow technical personnel in the same trade. It may also send technical people who are suited for technological and quality control work to the plants. A personnel exchange contract will be prepared in order not to alter the system.

(3) Transfer should be permitted for those who cannot fully utilize their knowledge because of education or other reasons. Furthermore, reforms in the personnel and labor system should be materialized soon.

(4) The quantity and quality of technical assistants should be improved. The superior level should issue instructions to the technology center to recruit qualified technical assistants.

(5) Perfect the personnel promotion and merit system at the technological development system so that the center has some autonomy.

D. Guarantee Funding and Its Effective Utilization.

It is most urgent to resolve the drawback of low economic benefits due to individually managed and arbitrarily spent research funds which are limited to start with. The establishment of technological development centers should closely link the utilization of research fundings with technical development needs. After the technical plan is formulated and approved, funding for key projects, including costs for research, pilot plant study and technological reforming, can be contracted by the center. After the anticipated technological and economical benefits are reached, the research results may be delivered to the plants for production.

The use of scarce and expensive research equipment should be dispatched by the technological development center. In order to reach an internationally recognized level in testing, advanced testing techniques and technologies may be introduced.

12553
CSO: 4008/155

BRIEFS

HENAN SCIENCE-TECHNOLOGY ORGAN--With the approval of the Provincial CPC Committee and the provincial government, the Henan Provincial Science and Technology Leadership Group was set up on 5 July. Governor He Zhukang has been appointed head of the group and Vice Governor Ji Hanxing and Provincial Science and Technology Committee Chairman Li Changze have been appointed the deputy heads. In accordance with the state's arrangements, the Provincial Science and Technology Leadership Group will transfer and employ science and technology personnel in light of need. The leadership group will exercise unified leadership over and will work out the province's long-term plan for science and technology, and will look into ways to deal with the new technological revolution throughout the province and into the important policies on technology. The leadership group will also examine and decide on the important technological items imported and technological transformation projects. [Summary] [Zhengzhou Henan Provincial Service in Mandarin 1230 GMT 7 Jul 84 HK]

CSO: 4008/385

PROPOSALS ON ESTABLISHING, MANAGING NATURAL PRESERVES ANALYZED

Shenyang SHENGTAIXUE [JOURNAL OF ECOLOGY] in Chinese No 4, 1983 pp 50-54

[Article by Bao Xiancheng [7637 7359 6134] of the Botany Institute, Chinese Academy of Sciences: "Some Ideas Concerning China's Natural Preserves"]

[Excerpts] The Objects of Protection in and the Types of Natural Preserves

Synthesizing the opinions and examples raised by relevant foreign and domestic agencies, along with the spirit of the documents passed by China's National Conference on Natural Preserves, convened between 1981 and 1983, we classify the objects of protection in natural preserves as follows.

1. Although ecological systems that are representative of different natural zones may have been damaged, they can, and indeed must, be restored and renewed. This includes various kinds of hilly land, mountains, plains, plateaus, wet land, water bodies and islands within the same zone.

2. Areas inhabited by endangered biological species that constitute special local products, are valuable or rare or have important economic value or scientific significance; or areas that have one or several representative communities, particularly typical gene pools.

3. Sites having special natural historic significance, such as headwaters, parent forests, snake islands, bird islands, geological cross sections, moraines, hot springs, waterfalls and areas having petrified objects; and regions and water bodies that must be preserved for scientific, educational or cultural reasons.

4. Natural scenic and historical sites with special significance.

Based on the above objects of preservation, we can classify preserves according to different criteria.[1] For example, preserves can be distinguished by natural zones, ecosystem type, object of preservation, use and functions. Because living things and nature form an indivisible whole, classification boundaries cannot be sharply drawn, and, in addition to the primary objects of protection, all related habitats and living things in any preserve also come under protection. Preserving the whole and protecting the natural ecological system serve better to protect the emphasized object. Therefore, a

preserve that has been selected for a certain specific objective inevitably becomes a large or a small natural ecosystem.

China has an immense population and little remaining natural vegetation. Consequently, we cannot adopt such complete preservation techniques as leaving everything perfectly intact and allowing nature to develop on its own. Rather, we should set up preserves that combine preservation, scientific research, production and even tourism. Thus preserves should not simply include virgin areas of natural vegetation but also incorporate some areas that are developed. To this end, some people[1,2] have proposed that we divide preserves into core areas, buffer zones, and peripheries (or experimental areas) and that we also determine their [?sic] functions and duties. This kind of preserve would not only protect natural ecosystems, allowing them to become a storehouse for seed sources, but would also become a place for education, scientific research, tourism, land transformation and creating more material wealth for society. Internationally, preserves of this type have been called biosphere reserves; some Third World nations have reportedly already experimented with them[3,4]; and practical experience has shown that the local people participate, that residents can still fully carry out the activities involved in their livelihood and that mountain people easily understand and accept such preserves

The Current Status of China's Natural Preserves

It is reported* that China has already established 85 preserves of varying types, which occupy 0.23 percent of the nation's territory. Of these, the Changbai Shan, Dinghu Shan and Wolong Preserves are part of the United Nations World Biosphere Preserve Network. At the same time, six preserves--Fujian's Wuyi Shan, Shaanxi's Foping, Gansu's Baishui Jiang, Sichuan's Wolong and Guangxi's Huaping and Longgang--have been designated as key national preserves. Apart from Taiwan, all provinces and autonomous regions are making plans for local nature preserves. And it is estimated that by 1985, there may be 500 preserves throughout the country, occupying as much as 1 percent of the nation's territory. However, even so, these levels will still be very insufficient, considering China's vast territory, complex natural conditions and rich, natural historical legacy. Compared to advances in the protection movement throughout the world, China still lags far behind. Now many countries use the proportion of national territory occupied by preserves not only as an important measure of the level of advancement attained in the protection of nature, but also as an indicator of modernization. Apart from insufficiency, China's natural preserves are flawed by a lack of variety, uneven distribution

* The figures cited here were made public at the November 1982 National Conference on Natural Preserves. The figures from the conference's Symposium Material 12 (Shi Guangfu [2457 0342 1318], "China's Natural Preserves") are the same, but Symposium Material 11 (Zhu Jing [2611 7231] and Wang Xianpu [3769 3759 3302], "Suggestions Concerning China's Natural Preserve Program") reported that there were 121 preserves. These two papers both reported no more than five preserves in Yunnan, but in 1982 the popular science publication KEXUE ZHI CHUANG [A WINDOW ON SCIENCE] (bimonthly), No 4, reported that Yunnan had 22 preserves and 12 protection sites (and described these in detail). Obviously, the precise figure awaits verification.

and irrational planning. Even the natural preserves that have already been set up have much irrationality.

Today, as China's natural resources undergo rapid change, in order effectively to establish preserves and to protect those things that should be protected, we should, on the one hand, make rational plans and arrangements on a national scope, starting from top to bottom and, on the other, carry out a comprehensive survey, from bottom to top, of existing preserves. We suggest that forms, such as the one presented below, be designed for and filled out by each preserve according to actual conditions and that the information obtained thereby be summarized, printed and distributed to all relevant units. In this way, leadership organs can clearly understand the general situation regarding the distribution, types, implementation and exact number of and human impact on preserves, in order to provide a reliable basis for planning and siting preserves and to provide channels for cooperation and exchange with research institutions, colleges and universities.

General Preserve Survey

Preserve name . . . . . Date established and unit giving approval . . . . . .

Function (natural preserve, protected area, water conservation site, no hunting area, national park, etc.) . . . .

Province/autonomous region . . . . Longitude . . . Latitude . . . . . .

Altitude: Highest (meters) . . Lowest (meters) . . Average (meters) . . . . .

Objects of protection . . . . . .

Total area of preserve (hectares) . . . . . .

Core area (strictly protected) . . . . . percent of total
Buffer area (normal protection) . . . . . percent of total
Periphery (multiple use area) . . . . . percent of total

Climate type (temperate, warm temperate, subtropical) . . . . . .

Annual rainfall (mm) . . . . . Rainfall in wettest month (mm) . . . . . .

Average annual temperature (°C) . . . . . Coldest month (°C) . . . . . .

Hottest month (°C) . . . . . .

Topographical type (plains, mountains, gorges, glaciers, sand dunes, lakes, river basins, swamps, seashore, etc.) . . . . . .

Primary vegetation type and rare species . . . . . .

Faunal characteristics and rare species . . . . . .

Extent of human influence (percent of total preserve area):

not evident . . percent; limited . . percent; severe . . percent

Scope of economic management (percent of total preserve area)

necessary . . percent; not necessary . . percent

Advisory and cooperating research units . . . . . .

Documentary material recording or studying the natural history of the preserve (with emphasis on biological aspects):

1. . . . . .
2. . . . . .
3. . . . . .
4. . . . . .
5. . . . . .

Note: Do not fill in items that are not clear or uncertain.

Proposals for Planning, Siting and Demarcating China's Natural Preserves

In principle, everyone advocates that the four types of objects of protection, discussed above, should be taken into consideration in the planning and siting of preserves. But because emphasis varies, differences arise in concrete demarcation proposals, which generally can be divided into two types.

The first type combines natural preserves and administrative districts and is represented in the documents of the 1980 National Conference for the Demarcation of Natural Preserves, which divided the nation into nine regions: The northeast mountainous and plains region; the northern plains, hilly and loess-plateau region; the eastern, subtropical, hilly and plains region; the subtropical hilly and mountainous regions of southwestern central China; the southern, tropical, mountainous and hilly region; the lateral mountain ranges of the southwest; the arid wasteland and deserts of Inner Mongolia and Xinjiang; the alpine plateau of Qinghai and Tibet; and the region including tropical and subtropical Taiwan and the equatorial Hainan archipelago. These regions take differences among natural zones into rough consideration, but because the regions also share the features of administrative districts, primary water and temperature conditions vary within each region, in which many typical ecological systems thus can arise. At the same time, since the objects of protection vary among preserves, management and research work also differ, and thus intractable problems can arise. But because preserves also possess the features of administrative districts, existing, relevant agencies can carry out leadership and management in the current absence of a complete, top-to-bottom natural-preserve system.

The second type of proposal demarcates preserves according to differences in natural conditions and resources. This approach employs two methods of demarcation. The first proceeds from the viewpoint that vegetation forms the core of ecological systems; divides China's vegetation into three major types--forests, grasslands and deserts, and high mountains and plateaus; and on the basis of this typology, creates 13 regions. The second method provides a proposal for demarcating natural preserves based on the breakdown, "a classification of topographical biology-climate," presented in Table Three of the book "Zhongguo Zonghe Ziran Quhua" [China's Comprehensive Natural Regions] (first draft): 6 [?] temperature zones and 1 region; 18 nature regions, 28 natural zones and 90 natural districts.* These two methods closely approximate natural zones, and the basis for division is clear. Consequently, preserves within a single region or district all share fairly uniform ecological and biological conditions, which facilitates research work and exchange of ideas. But proposals such as these, especially the latter, four-level plan, are overly elaborate. Moreover, if we are to implement such proposals, we must establish independent agencies at all levels, forming a self-contained natural-preserve system, or reform relevant organs to suit them to the task.

The Basic Work of Preserves

Once preserves have been selected, we must conduct survey and planning work. First we must survey natural conditions according to each scientific discipline so as to understand natural background conditions, the effects of historical change and social production activities and the status of the surrounding environment. Then we must determine the area and boundaries of the preserve, set up management regulations and implement propaganda and educational measures that combine rewards and punishments. We must constantly observe natural development and record quantitative and qualitative changes in key natural elements so as to enable preserves to play an active role in maintaining ecological balance and preserving representative areas. This work generally can be divided into two kinds.

A. Routine work. That is, work that is directly related to management and supervision. 1) Conducting surveys of basic conditions at set times and places for the reference of concerned quarters, for example, gathering information on climate, phenology, geology, geomorphisms, and water and the number and distribution of living species. 2) In preserves where tourism is permitted, we should study the various kinds of influence that man has on the natural realm in order to find a way to maintain ecological balance within preserves and to satisfy the needs of the growing number of tourists. 3) Since most preserves are unable to become self-regulating ecological units, they are easily influenced directly or indirectly, by activities in surrounding areas and thus form "ecological islands."[6] Therefore, we must pay close attention to the question of whether or not animals, weeds, fertilizer and pollutants in surrounding areas affect preserves, and we must study ways to reduce or eliminate these effects. 4) Are the present areas and borders of preserves appropriate? It is generally believed that preserves should be as

* Zhu and Wang, "Suggestions."

large as possible and that they should be round in shape, so as to minimize the length of their boundaries. But some people,[7,8] viewing the problem from the standpoint of maintaining biological diversity, feel that long narrow strips represent the best shape, for long borders enable preserves to receive a broad range of seeds and not simply retain existing species. As for animals, many small preserves are better than one large preserve of equal area because animals roam about and can choose whether to move or to settle down.

B. Specialized work, that is, basic research in preserves. Every natural preserve should stress basic theoretical research, because in today's world, with steady increases in population and reductions in natural resources, no other place can substitute for these natural laboratories. Some problems that are encountered in routine preserve work can only be solved through long-term, thorough research. Since the functions and duties of preserves differ, allocation of special topics and strength must also vary. Here, we list for reference only some of the problems that are related to biological resources.

1. Studying the composition, structure, distribution and classification of organisms (animals, plants and microorganisms) within the ecological system. This can be done at the three levels--the individual, the colony and the ecosystem.

2. Studying the production process and productive forces of the ecosystem. This includes the utilization of photosynthesis and [?] primary productive forces; the transformation of energy at each trophic level; and the distribution, circulation and relation to productive forces of water and nutrients within organisms during environmental fluctuation.

3. Studying the rhythm and stability of the ecosystem. This includes succession within biological communities and the relationship of climatic changes and of transformations in biological populations to the stability of the ecosystem.

4. Systems analysis of ecological systems and research on the design and predictive models for optimal ecosystems. This includes the rational utilization of resources, such as by expanding local biological resources, and introducing and domesticating new seed varieties, multilevel artificial communities, the establishment of mathematical models and the like.

Insure Implementation of the Other Measures Necessary for the Development of Natural Preserves

A. From top to bottom, discuss and make preparations for specialized agencies to administer natural preserves; treat the establishment of natural preserves as a special sector of the national economy and include them in national planning; and avoid overlap between preserves and the production bases which are envisioned in long-range planning for economic development.

B. Preserves should strengthen cooperation and exchanges with relevant research units, colleges and universities and other preserves. When conditions

permit, preserves should also develop international exchanges and integrate research and training.

C. Accelerate training, establish more specialized classes for natural-resource protection in relevant institutions of high learning, and train existing staff.

D. Spread ecological education and require that everyone, from the leadership down to the masses, adopt the ideas of maintaining ecological balance and of working in accordance with the laws of nature. Only through common emphasis and effort by the entire society can natural protection work truly be done well.

E. Strengthen the legal system. Insure the "autonomy" of natural preserves. That is, no unit or individual may enter without permission from preserve administrations. Without this minimal authority, "preserves" will become empty forms.

FOOTNOTES

1. Wang Xianpu, DONGBEI LINXUEYUAN XUEBAO [JOURNAL OF THE NORTHEAST FORESTRY COLLEGE] No 2, 1980, pp 1-6.

2. Bao Xiancheng [7637 6134] and Cui Haiting [1508 3189 0080], ZHIWU SHENG-TAIXUE YU DIZHIWUXUE CONGKAN [BOTANICAL ECOLOGY AND GEOBOTANY SERIES], No 2, 1982, pp 153-156.

3. Jusigi, J.W., AMBIO, Vol 10, Nos 2-3, 1981.

4. Halffter, G., Ibid.

5. Wang Huenpu, PARKS, Vol 5, No 1, 1980.

6. Turner, J.S.F.A.A., THE AUSTRALIAN ACADEMY OF SCIENCE, 1980, pp 6-12.

7. Game, M., NATURE, No 287, 1981, pp 630-631.

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PROBLEMS IN XINJIANG'S AGRICULTURAL ECOSYSTEM DISCUSSED

Shenyang SHENGTAIXUE ZAZHI [JOURNAL OF ECOLOGY] in Chinese No 4, 1983 pp 27-30

[Article by Zhang Xuezu [1728 1331 4371], Zhu Maoshun [2612 2021 7311] and Yan Gengxue [0919 1649 7185] of the Xinjiang 1st August Agricultural College: "Establish a General Agricultural System in Xinjiang"]

[Text] I. The Characteristics of and Conditions in Xinjiang's Ecological System

A. The Ecological System of Xinjiang's Desert

Xinjiang is situated in the center of the middle latitudes of the Eurasian land mass and has a total area of approximately 1.65 million square kilometers, which is one-sixth of the total national territory. The region is the most arid in the nation, and southern Xinjiang is one of the driest areas of the world. Compared to other arid regions in the world, Xinjiang has the following two characteristics.

First, while all of the other major deserts of the world are located in the tropics, Xinjiang lies in the temperature zone, and its vast grasslands and low mountains have temperate desert climate. Sunlight is very strong, and total annual solar radiation is 125-133 kilocalories per square centimeter, second highest in the world. The sun shines for very long periods of time, averaging 2,550 to 3,500 hours annually. As a whole, Xinjiang averages only about 150 millimeters of rainfall per year, the seasonal and geographic distribution of which is very uneven. Thus, Xinjiang's weather is very special. That is, there is abundant sunshine and dramatic temperature differences: the summer is extremely hot, the winter is severely cold and daily fluctuations are very great, the annual average daily differential being 11°-16°C, which greatly facilitates photosynthesis. As an ecological system, Xinjiang is dominated to a certain extent by nonbiological, physical processes; has few plant and animal species; has low biological productivity; has a simple food chain; and forms a harsh habitat and an extremely fragile ecological system.

Second, Xinjiang is surrounded by three mountain ranges: the Altai Shan to the north, the Tian Shan in the center and the Kunlun Shan in the south. Between these three mountain systems lie the Dzungarian and Tarim Basins.

These ranges and basins are arranged vertically and in a beneficial way, forming, from top to bottom, belts of ice and snow, tall mountains, grassy marshlands, forests in medium- and high-altitude zones, and grasslands, oases and deserts north of the ranges. Those medium- and high-altitude places that receive the most rain are the sources of Xinjiang's rivers and provide a reliable guarantee for agricultural production in desert basins. The arid basins and the moist mountains together form Xinjiang's distinctive natural ecological system.

B. Desert Oases

Because of Xinjiang's natural ecological conditions and natural resources, the region possesses, at different altitudes, pastures that can be used year-round, and basin agriculture can also be developed through irrigation. Moreover, mountain forests and secondary forests of the flatlands can serve a protective function in the areas of water conservation, preserving the ecology for plains agriculture and animal husbandry, preventing dust storms, improving the microclimate of agricultural fields and benefiting the environment for human life. In areas where water, soil and thermal resources are in harmony, desert oases are formed. Oases contain agricultural fields, forests and grasslands; are conducive to an integrated economy of agriculture, forestry and animal husbandry; are the most active base areas for agricultural production and the activities of living things in the desert ecosystem; and have concentrated human populations, the activities of which have helped to form unique agricultural ecosystems in oases.

The total area of cultivated land in all of Xinjiang is about 8 million mu, 95-plus percent of which is irrigated agriculture. There are over 3 million mu of arid land in the grassy plains of northern Xinjiang, most of which was originally spring and autumn pastures. Water for irrigation comes primarily from mountain rivers, the runoff of which reaches 90.9 billion cubic meters but which must be supplemented by rain water and melted snow. River flow volume changes very little from year to year, making Xinjiang's sources of water some of the most stable in the nation. Next, there are 20 billion cubic meters of groundwater. And because of a combination of factors--including a guaranteed source of water for irrigation, ample solar resources, great temperature differences, dry air and dry soil that possesses unique geochemical traits--long-term cultivation and selection by various nationalities has produced many commercial crop varieties and superior breeds of livestock that are well known domestically and internationally. Many areas of Xinjiang basically employ single cropping, but parts of southern Xinjiang can be planted more than once a year, obtaining three harvests in 2 years or two harvests annually.

II. The Special Features and Present Condition of Xinjiang's Forest Ecology

A. The Forest Resources of Xinjiang

Xinjiang has few forests. Natural and man-made forests together do not make up even 1 percent of the region's total area, but since that area is vast, the absolute figures are not inconsiderable: Standing timber reserves total

237.56 million cubic meters, forestry land use equals 35,714,800 mu and valuable conifers comprise a very large proportion of the region's forest reserves, making Xinjiang first among the five northwestern provinces.

Xinjiang's natural forests are generally grouped in three areas: (1) the Tian Shan forest, (2) the Altai forest and (3) small parcels of flatland forest scattered along the banks of large rivers and on dry, groundwater-supplied river beds in the desert. These forests are largely comprised of diversiform-leaved and gray poplars. Mountainous areas account for 92.9 percent of the region's natural forest reserves and 65.6 percent of the total area thereof. Flatlands account for only 7.1 percent of these reserves and 34.4 percent of the total natural forest area. Two of Xinjiang's three centers of rainfall are the Altai and Tian Shan, which are mountainous areas having concentrated forests. A small number of forests are also scattered across the northern foothills of the Kunlun Shan. But this area is influenced by desert climate, and the desert extends to an altitude of 3,300-some meters, far higher than in the other two centers. Thus this area's forests are sparse, resemble parks and are not large in extent.

B. Evaluation of Xinjiang's Natural Forests

In evaluating forests, we must determine whether or not their ecological structures are complete. For many years, the forests have supplied Xinjiang's lumber needs, but destructive conditions have appeared because of improper cutting and poor management.

Forests in mountainous areas, for example, exhibit the following characteristics. (1) Sparse forests (having a canopy density of less than 0.3) are especially predominant, accounting for 29.32 percent of the region's total forest land area. Such forests are what is left after heavy cutting and are the result of damage to the ecological structure. The trees in such forests provide sources of seeds for repopulating tree species and restoring the ecological structure. Before undergrowth has been restored, such forests must not be recut. (2) Forest age structures are out of balance. Ideally, the areas covered by young, middle-aged and mature forests should be equal. Yet the ratio in Xinjiang is 1:2:2.3, and the imbalance is even more pronounced in mountainous areas, being 1:6:9.6. A small young-tree area presages the aging of forests, the exhausting of resources and a decline in the mature-tree area. (3) Regeneration is not keeping pace with logging. This is an inevitable result of stressing cutting and neglecting afforestation but is also due to the contradiction between forestry and animal husbandry. Even where young trees are regenerated, cattle and sheep may trample and kill them, thus prolonging nonregeneration.

C. Factors Leading to the Destruction of Xinjiang's Natural Forests

Concentration of logging in certain areas, so that harvests exceed growth, is the most direct factor contributing to the destruction of natural forests in Xinjiang's mountains.

The growth and decline of these forests are unique. Because climatic conditions are favorable, the average annual growth rate of Xinjiang's natural forests can reach 1.63 percent if forests are not destroyed. But because the ecological structure is fragile, once forests are damaged, recovery is extremely difficult. If forest management is poor, regression will ensue, and forests will become barren slopes. In view of Xinjiang's small young-forest area, regeneration will not prove easy. And if we do not strive to save mountain forests, the future will be very grave.

Flatland forests have met destruction because of the opening or the expansion of farms and the use of firewood as an energy source. For example, the cover area of the diversiform-leaved poplar in southern Xinjiang has fallen from 7.8 million mu in 1958 to 4.2 million mu in 1979, the forest area of the Yili He valley has dropped from 424,000 mu in 1964 to 355,000 mu in 1980 and the sacsaoul forest of the Dzungarian Basin has retreated 30-50 kilometers in 30-odd years.

III. The Special Features and Present Condition of Xinjiang's Prairie Ecosystem

A. Xinjiang's Prairie Resources

Xinjiang's prairie is characterized by a large area, wide distribution and great variety. (1) The effective area of natural grassland is about 736 million mu (taking the figure of 756 million mu established by the Xinjiang comprehensive survey team from the Chinese Academy of Sciences in 1960 and deducting 20 million mu that have been put into cultivation in the past 21 years), which ranks second only to Nei Monggol. (2) Apart from glaciers, steep cliffs, sand dunes and bare farmland, forage grassland is scattered everywhere, from the flatland desert to high and cold mountainous areas. (3) Prairie types are many and varied, and herding can be practiced under different climatic conditions and with different types of forage. Through artificial propagation on 2.8-plus million mu, high-quality purple-flowered alfalfa has facilitated year-round breeding of various kinds of livestock by providing new environments for herding and readjusting fodder.

B. Evaluations of Xinjiang's Prairies

A comprehensive evaluation, based on the needs of the prairie economy, of the quality and quantity of forage grass, pasture topography, water supply and improvements revealed that 37.5 percent of Xinjiang's prairies are of superior quality, some of which are of a quality that is seldom seen in China; 29 percent are of medium quality; and 33.5 percent are inferior.

There are three imbalances in Xinjiang's prairies.

1. Forage grass yield is low. Some 46.3 percent of all grassland consists of low-yield land producing less than 50 jin of grass per mu. In dry years, this yield declines by one-half.

2. Pastures are imbalanced seasonally, that is, the forage-grass supply is imbalanced seasonally. According to statistical data from early 1960, if we take the percentage of livestock fed on warm-season pastures as 100, then the percentage fed on cold-season grasslands is only 61 percent. And in the past 20 years, because cold-season grassland has constantly been opened up to cultivation, destroyed and withdrawn from grazing, the percentage has fallen to about 40 percent.

3. There is an imbalance between water and grass, which is to say that the distribution of river networks on the prairie is imbalanced, so that there are some prairie areas that have grass but lack water. According to statistics, there are about 400 million mu of middle-grade and inferior grasslands that have insufficient or no water and thus are useless or cannot be fully utilized.

C. Reasons for the Destruction of Xinjiang's Prairie Ecology

Opening prairies to cultivation is totally destructive to the ecological balance thereof. According to statistics, in the past 30-odd years, a total of 51.8 million mu of prairie in Xinjiang were developed, of which, about 30 million mu became farmland. In terms of land utilization, the establishment of a new agricultural ecosystem represents an improvement. But seen from the viewpoint of prairie animal-husbandry production, reclamation reduces winter and spring pastures and land from which grass is harvested, thus intensifying the shortage of cold-weather pastures and exacerbating the second imbalance discussed above. In addition, there has also been some blind reclamation--such as the approximately 20 million mu of land that was plowed up and reduced to wasteland, abandoned farmland and hastily developed fields--which destroyed the prairie ecosystem but by no means established a new stable farm ecosystem. Of course, this absolutely must be corrected.

IV. Recognizing the Problem of Imbalance in Xinjiang's Ecology

A brief review of several important problems regarding ecological balance that have arisen since the major development of Xinjiang's agriculture would doubtlessly benefit future development.

A. Extensive cultivation is widely practiced in agriculture, and yields have risen very slowly, the average annual increase for grain over the last 30 years being only 3.3 jin per mu. Rapacious forms of farming, which consider only the present and invest little efforts, create imbalances between material inputs and outputs and steadily deplete soil fertility. In newly reclaimed areas, irrational irrigation also continuously expands the area affected by soil salinization, which currently amounts to one-third of the cultivated land area.

B. Animal husbandry, particularly prairie operations, which resemble those of cultivation, are also rapacious. First comes indiscriminate reclamation, which depletes the natural fertility of grass-producing soil. Second is overgrazing, which reduces the regenerative capability of forage grass and causes a steady deterioration of prairies. We have yet to escape reliance on

nature in animal husbandry and instead blindly pursue year-end stockyard livestock in inventories, neglect quality and use natural attrition, such as weight loss and death, to regulate the balance between grass and livestock. For 30-odd years, the number of livestock that have been pressed to the point of death by cold and hunger averages 2 million head a year. The vicious cycles of summer life, autumn fattening, winter weight loss and spring death and of pasture overgrazing, deterioration, further overgazing and further deterioration are interwoven.

C. In forestry, cutting has been stressed and growth neglected in both mountainous and flatland forests, and harvests greatly exceed growth rates, being as much as two times greater in heavily logged areas. Xinjiang has 1.68 million rural households, 1.23 million, or 73.2 percent, of which lack sufficient firewood. Each year, up to 3.8 million tons of shrub cover is cut, causing a steady expansion in wasteland area.

D. Summing up, we lack a comprehensive, integrated concept of general agricultural development. In developing land resources, we must give adequate consideration to water conservation and to other resources. For without water, further land development is useless, and reclamation will be followed by abandonment of cultivation, increased soil salinization or the raising or lowering of water tables.

V. The Establishment of an Excellent General Agricultural Ecosystem Is the Long-term Strategic Goal for Developing Xinjiang's Agriculture

A. Establish a Comprehensive Policy Combining Farming, Forestry and Animal Husbandry and Gradually Adjust the Production Structure of Agriculture

To really solve agricultural problems we must begin from the general agricultural ecosystem; firmly establish a guiding ideology which combines farming, forestry and animal husbandry; and avoid returning to the previous tendency of stressing only one sector to the detriment of the integrity of ecology, which is indivisible. We must gradually transform the old production structure, which primarily emphasized grain and treated forestry, animal husbandry, sideline occupations and fishery as supplementary, to one which places equal emphasis on farming, forestry and animal husbandry and provides for the comprehensive development of farming, forestry, animal husbandry, sideline occupations and fishery. Readjusting the agricultural production structure means finding the very best such structure and follows the principles of "tailoring measures to suit local conditions, emphasizing advantages and avoiding disadvantages, looking ahead while considering the past, achieving overall balance, measuring our strength before proceeding and gradually making adjustments."

Xinjiang must firm aim its main attack on yields; otherwise, increases in forest on grassland areas will be hard to insure.

B. Forests Must Advance Toward the Flatlands

The forest ecosystem is the most intensified ecosystem. In arid Xinjiang, forests occupy an especially important position, for they influence farming

and animal husbandry, which we engage in and rely on for our livelihood, and enhance our ability to set our feet firmly in the region. But objectively, both mountainous and flatland forests are severely damaged, and thus we must:

1. Energetically protect and grow trees in mountainous areas, greatly reduce logging and eliminate poaching. We must invest in forest areas, expand tree farms and reduce consumption.

2. Energetically create a shelter forest system of narrow belts and small networks on flatlands and incorporate farming and animal husbandry into this system. In this way, we will be able to transform the agricultural environment of arid areas, prevent and check sand storms and erosion and, within 15 or 20 years, take large amounts of commercial lumber, undergrowth and shrubs through rotation of primary trees. We must move some of the logging bases to the flatlands so as to reduce pressure on mountains and solve the village energy problem. When the latter is alleviated, we can then return straw to the fields to raise soil fertility and use part of the straw to increase fodder, expand animal husbandry in villages and produce large quantities of manure.

To this end, we propose the slogan of "advancing forests toward the plains," withdrawing some low-yield fields from cultivation and returning them to forest or pasture, creating fuel forests, transforming plowed-up wilderness into mixed pasture and forest land (that is two-storied grasslands).

C. Formulate a Correct Policy for Prairie Farming, Raise the Efficiency of Animal Husbandry and Energetically Plant Grass

One correct policy for prairie farming is that we must implement management of grazing grass in order to produce high-quality, high-yield forage grass and fodder. Another policy is that we must implement management of livestock, regulate herd size and enlarge the proportion of dams, the objective of which is to insure proper utilization of forage so that we can raise even more livestock.

The prairie is a living resource, and only if we use it rationally can it regenerate itself and carry out natural reproduction. By making the most of this asset, we can then engage in low-cost prairie animal husbandry production. The key to rational exploitation of the prairie is adopting the proper degree of grazing and studying and clarifying the prairie's utilization rate, 50 percent generally being suitable. Control of grazing intensity requires planned adjustment and further consolidation of the responsibility system in animal husbandry production.

To maintain natural balance in the prairie ecosystem, we must also adapt herding to the seasonal changes in forage production and take advantage of summer forage grass, which is more plentiful and of higher quality, in order to raise more livestock. When autumn arrives, we must adjust herd sizes in accordance with grasslands' cold-season livestock-support capability, determine stockyard inventories, slaughter and sell the additional livestock that were raised in the summer and thus obtain animal products. This represents seasonal animal husbandry and is already achieving results in the Altai pastoral area.

Because the natural growth of forage grass is severely affected by the climate, grass yields greatly decline in disaster years, a process that is an important cause of instability in animal husbandry. Therefore, we must energetically develop grass planting, carry out grass rotation in pastoral areas or establish semi-artificial grasslands to supplement natural forage grass. In farming areas, we must intersperse forest networks and grass fields in order to supplement inadequate supplies of winter grass and to raise soil fertility. We must extend grass and shrub belts around the peripheries of oases to shield against the wind, hold sand down and protect oases. And by the end of the century, we should expand the area of grass cultivation to about 20 percent of that of arable land.

D. Carry Out Hydraulic Construction and Raise the Economic Results of Water Conservation in Accordance With River-basin Plans

The most striking feature of arid areas is the extreme imbalance between water and heat. When we carry out basic hydraulic construction, we must combine engineering and biological measures, and the former must be based on river-basin plans. River-basin planning work is comprehensive; can and must coordinate the relationships between all industries in the entire basin ecosystem, between departments and between all areas in the upper, middle and lower reaches of the river; and conduct overall planning. Our current emphasis is on preventing seepage in water-distribution systems and canals. We must strengthen irrigation management and lower irrigation quotas in order to conserve water and raise the utilization rate for water.

E. Further Disseminate the Science of Ecology and Strengthen Ecological Re-Research Work

As we develop and utilize agricultural resources, we must not destroy natural resources or harm the ecological environment. In the final analysis, we must further disseminate ecological knowledge, thoroughly and painstakingly carry out scientific research, and make a special effort to select representative places to conduct fixed-site ecosystem research and to accumulate primary data to serve as a scientific basis to guide the development of the five fields of farming, forestry, animal husbandry, sideline occupations and fishery.

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ENVIRONMENTAL PROBLEMS IN CHANG JIANG BASIN DISCUSSED

Shenyang SHENGTAIXUE ZAZHI [JOURNAL OF ECOLOGY] in Chinese No 4, 1983 pp 34-37

[Article by Wang Chaojun [3769 6389 0193] of the Institute of Water Resource Protection of the Chang Jiang: "Some Geological Problems Facing the Chang Jiang Basin"]

[Text] The Chang Jiang basin, 1.8 million square kilometers in extent, is spread over 18 provinces, municipalities and autonomous regions and has a temperate climate, plentiful rain, excellent natural conditions and abundant natural resources. According to statistics, the basin has 370 million mu of cultivated land, or 25 percent of the nation's total, and produces over 40 percent of the nation's total agricultural product, 70 percent of the nation's paddy rice and one-third of the nation's cotton. The mineral resources of the Chang Jiang basin are also very rich, and its water, soil, forest and fishery resources occupy important positions nationally as well. Mountainous areas predominate in the basin, occupying 65.6 percent of its total area, hilly land, 24 percent and lakes and plains, 10 percent.

In the past few decades, with the sharp rise in population, there has been a steep increase in demands upon and development and utilization of natural resources. And due to a lack of understanding regarding environmental questions and of flaws in environmental work, some places do not carry out their economic construction in accordance with natural and economic laws and have rapaciously managed and harmed some natural resources. Thus, the ecology has become unbalanced and the natural environment has deteriorated, severely affecting the people's livelihood and industrial and agricultural production. Below we shall briefly discuss some of the problems presently facing natural resources and the ecological systems of the Chang Jiang basin in order to gain the attention of concerned quarters.

I. The Sharp Decline in Forest Resources

The forested area of the basin is 300,000 square kilometers, most of which is located in the southwest and in the western parts of central China. There are over 500,000 square kilometers of mountainous and hilly wasteland that are suited to forests and that could be used for extensive afforestation and for developing various kinds of commercial forests.

Since liberation, the forested area has declined by an alarming extent and at an alarming speed due to blind forest destruction, reclamation, wanton cutting, forest fires and poor economic management, which stresses cutting while neglecting replanting, all of which have caused serious destruction. Yunnan's forest cover has dropped from 50 percent in the early 1950's to the current 24.9 percent, and lumber reserves have fallen from 1.2 billion cubic meters in 1962 to 988 million cubic meters in 1975. Sichuan's forest cover ratio was about 19 percent right after Liberation but was devastated by the end of the 1950's, leaving only 13.3 percent in recent years. According to a survey of 193 Sichuan counties conducted by relevant departments in 1979, only 12 counties had forest cover ratios as high as 30 percent; 91 counties had only 10 percent; nearly one-half of the 53 counties in central Sichuan did not even have 3 percent, and some had less than 1 percent; and Chongqing City and Fuling and Wanxian Prefectures, which are located on the main branch of the Chang Jiang, had about 10 percent. Currently, the annual forest growth rate for all of Sichuan is approximately 16 million cubic meters, but consumption exceeds 25 million cubic meters. Some people estimate that if vigorous protective measures are not adopted, the present consumption rate will exhaust Sichuan's forest resources by the end of the century or a little later. Hunan's forests have suffered two major periods of destruction. Reserves fell from 213 million cubic meters in 1959 to 187 million cubic meters by 1976, the area destroyed and reclaimed in 1978 reached 700,000 mu and 1,000 square kilometers of purple hills near Hengyang are almost denuded. Just after liberation, Hubei had 60 million cubic meters of mature lumber reserves, but now only 30 million remain; certain famous forest specialty products have greatly declined; and in the past 3 years, another 200,000 mu have been destroyed.

II. The Present Status of Soil Erosion and Its Dangers

A. Soil Erosion Steadily Increases

The destruction of forests and vegetation is a major cause of soil erosion. According to surveys, soil erosion affects 360,000 square kilometers in the Chang Jiang basin, and about one-fifth of the land in the basin is losing its topsoil. It is estimated that every year about 2.4 billion tons of soil are washed away throughout the basin. Of this amount, 1.3 billion tons is from the upper region of the Chang Jiang, where erosion occurs on barren mountain slopes. The nutrients leached from topsoil each year convert to 6.5 million tons of potassium, equivalent to the loss of 1-year's production from 50 chemical fertilizer plants, each of which produces 200,000 tons. Sichuan, which ranks first in the nation in both population and cultivated land, also has the most severe soil erosion in the Chang Jiang basin. According to a recent survey, 67.52 percent of the province's total area of 570,000 square kilometers is affected by soil erosion. According to survey data from the Chang Jiang Chongqing station, the silt load averages 460 million tons in most years. The Jialing Jiang, the Tuo Jiang and the Fu Jiang annually wash away 250 million tons of silt, which is equal to the loss of a 5-inch layer of rich soil from 1.6 million mu of cultivated land. The area affected by soil erosion in Hunan is 56,600 square kilometers, or 27 percent of the province's total area. Each year 170 million tons of surface soil erode,

and the nutrients thus lost exceed the total amount of chemical fertilizer applied in the entire province in 1978. Jiangxi annually loses 160 million tons of soil and in some areas, 1 to 4 centimeters of topsoil. We should be attentive to the fact that, following the destruction of forest and vegetal cover and blind reclamation, soil erosion continues to expand in some areas.

II. The Serious Menance of Soil Erosion

Soil erosion is a serious menace. Lowered soil fertility and silt-tamped fields directly threaten the production of agriculture, forestry, animal husbandry, fishery and sideline occupations. In Hunan's Pingchuan district, about 7 million mu of farmland have been damaged by soil erosion, and average annual yields have declined by about 100 jin. It is estimated that, throughout the province, the annual average production of rice paddies whose tilled layer has been acidified by yellow mud has declined by about 200 million jin. Reservoir silting also has a serious effect, reducing the efficiency and shortening the life of reservoirs. Hunan has 13 reservoirs having a capacity of over 100 million cubic meters, and 5 of which are severely silted. Between 1967 and 1976, the Danjiangkou Reservoir was filled with nearly 700 million tons of silt.

Soil erosion increases river silt loads, raises river beds and blocks harbors and river channels. Every year some 500 million tons of silt enter the East China Sea from the Chang Jiang. and Because the silt is impeded by countervailing tidal currents, it is deposited and creates a huge sandbar at the river's mouth, forcing large ocean vessels to wait for the high tide in order to pass. Zhenjiang used to have an excellent harbor, but because of the accumulation of silt over the years, the original navigational channel had to be abandoned. At the Jing Jiang section of the Chang Jiang's middle reaches, the river bed is unstable, there are many shallow shoals that shift a lot and during the 40-140 day dry season there is no guarantee of a standard navigable depth. Even though the mainstream of the Chang Jiang has not transported much silt into the sea in the past few decades, some small- and middle-sized branches that have serious forest and vegetation damage have seen a marked increase in silting, and their beds have silted up with increasing rapidity. According to surveys, between 1964 and 1974, the average silt load in the upper reaches of the Min Jiang was 8.06 million tons, and in recent years this has increased to 12 million tons. The channels of eight small branches on the lower reaches of the Jian Jiang in northwest Sichuan originally were several meters to several dozen meters deep but have all silted up and become shallow, several hundred meters wide and strewn with rocks and shoals. In the past 10 years, the silt load of Hunan's Xiang Jiang increased 39.6 percent over the previous decade, and the river bed has risen 40 to 60 centimeters in the Zhuzhou and Hengyang section. The silt load in Jiangxi's Gan Shui, Fu Shui, Xin Shui, Rao Shui and Xiu Shui was 23 percent higher between 1966 and 1975 than it was between 1956 and 1965, and in the latter decade, the amount of sand that entered the Chang Jiang at Poyang Hu was 21.7 percent greater than in the previous 10 years. The Qing Jiang, a branch of the Chang Jiang in Hubei, has become known as "muddy river" because its annual silt load is 1.41 million tons. Accumulated silt reduces navigable mileage or cuts off navigation entirely. According to statistics from concerned departments in Hunan, there are 590 rivers in the province that have basins larger

than 100 square kilometers and which have a total length over 32,800 kilometers. After liberation, the province's navigable mileage increased to 16,000 kilometers, linking over 70 counties, cities and towns. But now this has shrunk to just over 6,000 kilometers. Navigable river mileage in Jiangxi shrunk nearly 1,000 kilometers between 1957 and 1978. And silting in Hubei's Yingshan He has completely closed the river to navigation and almost transformed it into the "Yingshan road."

III. The Sharp Decrease in Lake Area

Lakes in the Chang Jiang basin are primarily situated in its middle and lower reaches. In the 1950's, the basin had a lake area of 22,000-plus square kilometers. But because of reclamation, silting and other factors, that area has fallen to 12,000 square kilometers. In 1957, China's largest lake, Poyang Hu, had an area of 7.15 million mu, but 1.3 million mu have since been filled in. Dongting Hu, which used to be called "100-li Dongting," has been extensively filled in and silted up, so its water area has sharply declined. On average 140 million tons of silt annually flow into and settle in the lake from the Chang Jiang and the Xiang, the Zi, the Yuan and the Li Shui. Between 1954 and 1978, the natural lake area shrunk from 3,915 to 2,740 square kilometers, a reduction of 33.5 percent, and in the 30 years since liberation, the lake has shrunk at an average rate of 80,000 mu per year. In recent years, the lake bottom has silted up and risen at an average annual rate of 8.5 centimeters, and the lake's water volume is constantly declining. Hubei, which is commonly called "the land of 1,000 lakes," had a total water area of 8,300 square kilometers right after liberation, but this area has now shrunk to 2,300 square kilometers. Only 28 percent of the province's original lake area now remains, and the number of lakes has fallen from 1,066 to 326. Anhui's lake area has shrunk from 4.04 to 1.41 million mu, 65 percent of the original area having been reclaimed. Since 1959, Jiangsu, the "land of rivers and ponds," has had its lake area reduced by 1,600 square kilometers, or one-seventh of the province's total lake area, and 23 small- and medium-size lakes have completely disappeared. According to incomplete statistics, more than 17 million mu of lake area in the Chang Jiang basin have been filled in. Appropriate lake reclamation, combined with the eradication of blood flukes, is necessary for the expansion of agricultural production and to guarantee the health of the people but must be done in a way that suits local conditions and with overall planning and consideration. Excessive reclamation causes a sharp decline in the water area, affects ecological balance, reduces aquatic resources, severely weakens lakes' water-storage adjustment capacity, causes changes in microclimates and increases incidence of both drought and floods. The total storage adjustment capacity of Hubei's rivers and lakes, which originally totaled 8.3 billion cubic meters, has declined by about 3 billion cubic meters. In addition, silting has raised the water levels of some lakes and rivers, creating a situation in which such levels are higher than surrounding fields and where waterlogging and drought are prone to occur. Hubei's Jingzhou Prefecture has reclaimed a total of 4.33 million mu of lake area in the past 30 years, greatly reducing the natural water surface and forcing this prefecture, which historically was called the "water bag," to bring in water to transplant rice seedlings during dry springs. In dry years 60 percent of the prefecture must combat drought, and in wet years

flooding occurs on 40 percent of the prefecture's land. In fact, there are occurrences of flooding in dry years and drought in wet years, all of which affect agricultural production.

IV. Fishery Resources Have Been Seriously Reduced

The 10,000-li Chang Jiang has a distant source, a long course, many tributaries, a multitude of lakes, much natural aquatic food and abundant fresh-water fish resources. According to incomplete statistics, the basin has a fresh-water area of about 95 million mu, of which 35.66 million mu can be used for aquatic breeding. This latter figure constitutes about 48 percent of the nation's inland water area that can be used for breeding, and the basin accounts for about two-thirds of the nation's total fresh-water fish production. There are some 276 varieties of fish in the Chang Jiang, 50 of which are primary commercial varieties. Because man's productive activities have long violated objective natural laws, the ecological environment for fish has been damaged, engendering a sharp drop in fish resources and causing changes in the composition of the fish varieties. According to statistics, the Chang Jiang's natural catch was close to 400,000 tons in 1956, but during most years in the 1970's, fluctuated at about 200,000 tons. There was an even greater decline during the same period in the provinces of the middle and lower reaches of the Chang Jiang that have large water areas and abundant fish resources. Hubei's catch fell 60 percent, and production in 1977 equaled only one-seventh that of the peak year. Hunan's average annual catch was 630,000 dan in the 1950's, but fell to 310,000 dan in the 1970's, a reduction of over 50 percent. The decline for Anhui was 55 percent and for Jiangsu, 33 percent; indeed, the "land of fish and rice" found it difficult to eat fish. Sichuan's fresh-water area is just over 4 million mu, but per-capita fish production in 1979 was less than 1 jin. Not only did the catch drop, but the quality changed too. Fish were smaller in size, and fewer types were caught in rivers and lakes. Output of the famous Chang Jiang reeves shad has dropped sharply; the black carp, grass carp, silver carp, variegated carp and other major commercial fish which used to teem in the Hong Hu, Chao Hu and Tai Hu have noticeably declined; and small fish and small shrimp now predominate。 Yueyang's Dongting Hu Commune caught 24,000 dan of fish in 1979, 70 percent of which were small. There are many causes of this decline in fish resources, but the primary reasons are that, for a long time the slogan "take grain as the key link" was emphasized, agriculture was stressed, fishery was slighted, reclamation was excessive and comprehensive utilization of fish resources was neglected, all of which caused a large reduction in lake area that was suitable for fish habitation, growth and propagation. Dikes and flood gates were built on many lakes that flow into rivers, obstructing fish passage between lake and stream. Since liberation, over 7,000 culverts and flood gates have been constructed along rivers, very few of which have facilities to allow fish passage. The basin already has some 7.7 million mu of reservoir area, but planned, scientific fish stocking has been insufficient. Management and supervision are poor, fish have been overharvested, ponds have been drained to catch fish, ecological balance has been destroyed and the conditions for the survival of fish are threatened. Beyond this, water pollution and silt build-up affect the growth and propagation of fish.

V. Water Pollution Is Increasingly Serious

The Chang Jiang has abundant water resources, and every year about 1 trillion cubic meters of water flow into the sea. Due to the influence of human activities, particularly industrial development since liberation, we have neglected to protect water resources, and much untreated wastewater and other refuse has been discharged directly into the water bodies. The Chang Jiang carries a large volume of water and has a large capacity for self-purification through dilution, and thus the river's water quality remains fairly good. But river banks in sections that are near cities or industrial and mining areas are polluted to varying degrees. According to surveys, there are over 40,000 sources of pollution in the entire basin, which are primarily concentrated in 50 large and medium cities and in industrial and mining areas and which discharge about 30 million tons of wastewater each day and nearly 10 billion cubic meters each year, equivalent to one-fifth the amount of water in the Huang He. In this wastewater, large amounts and over 30 different types of toxic material have been detected, including phenols, cyanide, mercury, arsenic, chromium, cadmium, lead, copper, zinc, organic chlorine and oil, all of whose net discharge is very large. The daily discharge of the "five poisons," for example, runs as follows: phenols, 21,000 kilograms; cyanide, 14,000 kilograms; mercury, 360 kilograms; arsenic, 6,100 kilograms; and chromium, 3,200 kilograms. Forty-two percent of the material discharged from outfalls dumping directly into the Chang Jiang exceed standards. The total length of polluted river banks is 510 kilometers, or 14 percent of the length of the mainstream below Dukou. Because the Chang Jiang is broad, water for domestic use and industrial and agricultural production is largely drawn close to shore. Thus river-bank water quality directly affects people's health and industrial and agricultural production. Some sections of the river have already created adverse effects and harm. Water pollution has influenced the quality of and increased toxic residue in fish. A 1975 survey by departments concerned obtained a 100-percent mercury detection rate for the principal commercial fish varieties in the middle and lower reaches of the Chang Jiang and found other toxic materials, such as phenols and organic chlorine, in some fish. And cases of acute arsenic poisoning have occurred among boat people who drink water from the river in the section near Huzhou [sic], Sichuan.

Data obtained from surveys and analysis conducted at over 700 monitoring stations on over 50 tributaries and lakes show that pollution exists in varying degrees near cities and industrial and mining areas; that some rivers and lakes have actually become receptacles for wastewater and refuse; and that some streams and lakes that were once beautiful, clear and teeming with fish now reek, are devoid of fish and shrimp, have experienced destruction of their natural scenery and endanger human health and ecological systems.

In summary, the deterioration of some of the Chang Jiang basin's natural resources, particularly forests, soil and fish, is already very serious. Management methods that violate natural laws, impair the environment and destroy ecological balance cannot be permitted to continue. Places whose ecological balance has been seriously damaged have all been punished by nature. Facts demonstrate that protecting and rationally exploiting natural resources, maintaining and establishing ecological balance, and creating a beautiful environment that suits economic development and is conducive to the health are important tasks affecting the four modernizations and our posterity.

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SUCCESSES, PROBLEMS IN CONTROLLING POLLUTION IN JIANGSU

Wuxi Film Plant

Nanjing XINHUA RIBAO in Chinese 10 Nov 83 p 2

[Article by Wang Xingke [3076 5281 2688] and Zhao Jinyuan [6392 6930 3293]: "Wastewater From the Wuxi Cinefilm Manufacturing Plant Conforms to Emission Standards; Controls Actively Instituted; Tai Hu Protected"]

[Text] The Wuxi Cinefilm Manufacturing Plant, located on the shore of Tai Hu, strictly handles its industrial wastewater, the quality of which now conforms to the state's emission standards.

The plant emits 70 tons of industrial wastewater per hour, and this water contains various pollutants. The plant is located close to Tai Hu, which is one of the state's key protection areas. The plant leadership fully realizes that proper treatment of these large daily emissions and protecting lake water from pollution are of direct relevance not only to the question of whether the plant should remain close to Tai Hu, but also to the larger matter of protecting the people's health. Proceeding from this understanding, the plant established an environmental-protection staff consisting of 8 engineers and assistant engineers and 60-plus specially trained personnel, formed a network from the plant-administration level down to workshops and work teams, gave priority to furnishing all equipment and material that would be needed in environmental protection work, and thus created favorable conditions to insure the effectiveness of such work.

The plant specially set aside 90 mu of land and invested 2.5 million yuan to build a large wastewater treatment plant and renovated the equipment therein eight times in order to meet design specifications. Analysis of lake-water samples drawn from the vicinity of the plant confirmed that the plant's wastewater emissions now conform to the standards prescribed by the state.

The plant additionally adopted four measures to control and treat wastes and to protect and improve the environment. First, in future expansions, production will mainly be limited to items that will not, or will cause only little, pollution, thereby reducing as far as possible the sources of pollution. Second, the entire plant will carry out environmental protection work through a three-level system of economic responsibility and closely link the quality

of environmental protection work with the economic interests of every individual. Third, when production tasks are handed down each month, workshops that are major sources of pollution will be simultaneously issued pollution control targets. These targets must not be exceeded, and whoever does so will be held responsible. Supervision and monitoring workshops that generally emit pollutants will be strengthened. Fourth, while controlling wastewater generated in production, the plant will also check sporadic waste spills and dumping caused by experimental operations, so as to prevent environmental pollution.

Nanjing Oil Refinery

Nanjing XINHUA RIBAO in Chinese 10 Nov 83 p 2

[Article by Xie Zhiliang [6200 2784 2733] and Zhou Zhengrong [0719 2973 2837]: "The Nanjing Oil Refinery Fulfills the State's Pollution Control Requirements Ahead of Deadline; Quality of Wastewater Emitted Into the Chang Jiang Meets Emission Specifications; the Air in the Plant Area Is Clear and Fresh"]

[Text] The recent good news from the Nanjing Oil Refinery is that the plant spent the equivalent of only 3 years' pollution fines basically to control serious pollution from the "three wastes."

Since 1977, the refinery's production capacity has undergone steady expansion, and control of the "three wastes" for a while did not keep pace. This led to serious environmental pollution, and thus the refinery was listed by the state among the first group of enterprises that was required to control pollution within a set time limit. Today, 6 years later, people see many gratifying changes when they visit the plant.

The 10-odd-li strip of polluted water on the Chang Jiang has basically disappeared. In the past, the wastewater discharged by the plant had an oil content that exceeded the standards prescribed by the state and created a shiny oil slick half a li wide and 10-odd li long. Drinking water in the plant had a queer taste, so many staff members brought their own water to work. The plant has built four large wastewater treatment and water-purification installations, and wastewater passes through several stages of purification and treatment before being emitted into the Chang Jiang when the quality of that water meets the state's discharge standards. Staff members now can drink this water just as they can do tap water in the city.

The "poisonous dragon" of black, yellow and white smoke has been eliminated. The toxic gases which were emitted during production and formed this tri-colored "poisonous dragon," that previously hovered over the plant, are now being recovered and treated, some being used to supplement energy required for production purposes and some being turned, decomposed and released as harmless gases. Now that the air has become clear and fresh, the entire plant area is covered with lush green trees and bright-colored flowers.

The large, malodorous refuse pit has become a broad thoroughfare. In the past, acidic waste was dumped into a pit 30 meters in circumference, which usually emitted foul vapors, leaked and overflowed, thus polluting the air,

the soil and river water. An exceptionally large rainstorm in 1976 caused over 1,000 tons of acidic waste to spill into rural irrigation systems and damage 100-plus mu of farmland in 11 nearby production teams. Now the pit has been filled and converted into a road, along which, new multipurpose workshops have been built. The acidic waste is now being converted into the nitrogeneous fertilizer ammonium sulfate, which makes the farmers beam with smiles. In the past several years, the Nanjing Oil Refinery has combined technical innovations and energy-saving renovations and completed four construction projects mandated by the state to control the "three wastes" and three projects mandated by the province and the city. Investment therefor totaled 16.48 million yuan, and pollutant-discharge fees annually rendered by the plant, declined from 5.53-plus million yuan in 1981 to 410,000-some yuan in 1982. Between 1975 and 1981, the plant paid over 320,000 yuan, as compensation for agricultural losses caused by its pollution, but last year the plant did not have to make such payment. This means that the plant spent only the equivalent of 3 years' pollution fines to basically control its serious pollution problems. Completion of these control projects both markedly improved the environment and raised economic results. According to incomplete statistics, by transforming wastes into valuable products and harm into profit, the refinery from 1979 to 1982 recovered gas, contaminated oil, sulfur, ammonium sulfate and the like totaling 18.48 million yuan in value. And from January to August of this year, the value of recovered products amounted to 7.67 million yuan.

Rectification of Attitudes Advocated

Nanjing XINHUA RIBAO in Chinese 10 Nov 83 p 2

[Commentary: "Correct People's Attitudes Concerning the Control of the 'Three Wastes'"]

[Text] The excellent successes of the Wuxi Cinefilm Manufacturing Plant and the Nanjing Oil Refinery in effectively controlling the "three wastes" deserve high praise.

However, some units still do not accord environmental protection work its due place and do not energetically pursue this work. And a small minority of units have been repeatedly criticized, yet treat pollution as their own affair and have done little to improve conditions. The primary reason for this failure is that people's attitudes have yet to be corrected.

First, many people take the view that production targets are inflexible and that environmental protection is a soft task, emphasize production and slight environmental protection. Environmental pollution and ecological destruction are new problems resulting from the development of industry and agriculture. The more we neglect to control these problems, the more serious will be the harm from them. Not only is the environment polluted, but people's health is also directly threatened. If environmental protection is not emphasized, both this and future generations will be harmed. This is a problem that must not be treated lightly. To repeat, a deterioration in environmental quality affects the health of staff and workers and makes enterprise production hard

to improve. Thus we must simultaneously stress production and control of the "three wastes" and coordinate economic and environmental development.

Second, some people believe that environmental protection costs money and thus will adversely affect the economic results of our enterprises. If we are to stress economic results, we must consider all three aspects--economic, environmental and social results--as one entity. Every industrial and mining enterprise ought to incorporate pollution control in production. If environmental protection is ignored and environmental quality sacrificed for expansion of production, the economic benefit derived will not be genuine but adulterated and, more bluntly, spurious. In fact, controlling the "three wastes" is not all expense and no yields. For many units have recovered large amounts of useful materials in this work and have turned wastes into valuable products, thereby even increasing incomes. In short, in environmental protection work we must advocate awareness of cardinal principles and consideration of the overall situation, and under no circumstances must we neglect pollution, destroy ecological balance or harm society for selfish and temporary advantage.

Third, there are also some who believe that paying pollutant-discharge fees buys pollution rights, ignore criticism from staff and workers in their factories and the outcry from the masses around their factories and remain insensitive to and take no notice of the toxic and hazardous materials that their factories emit. It must be pointed out that the state collects discharge fees from units that exceed pollution standards in order to restrain, stimulate and urge those units quickly to adopt measures that will eliminate pollution as soon as possible. Every enterprise and individual is obligated to do the utmost to actively bring pollution under control, and no one has the slightest right to engage in wanton pollution. Wanton pollution is something that society, the people, morality and the law will not permit. The idea of buying that right is completely unacceptable.

Appropriate concentration of strength to resolve industrial pollution is an important task of industrial cities. It has already been 4 years since the Environmental Protection Law was promulgated, and we must rectify people's attitudes, strengthen the concept of the legal system, accelerate control, strive to synchronize advances in production and environmental protection and pursue urban construction even more effectively.

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YUNNAN FERTILIZER PLANT MEETS EFFLUENT STANDARDS

Kunming YUNNAN RIBAO in Chinese 27 Dec 83 p 2

[Article by Meng Guangan [1322 1639 1344] and Hu Yue [5170 6460]: "Emphasize Control of the 'Three Wastes,' Do a Good Job of Environmental Protection; The Zhanyi Chemical Fertilizer Plant Meets State Standards for Wastewater Emission"]

[Text] In recent years, while stressing production, the Zhanyi Chemical Fertilizer Plant has simultaneously adopted positive measures properly to treat wastewater generated during production so that emissions have now met the standards prescribed by the state.

Following promulgation of the Environmental Protection Law, the plant paid special attention to controlling the "three wastes," established monitoring stations, instituted a system of daily checks and perfected monitoring procedures and work. In order to reduce the cyanogen content of wastewater, the plant set up treatment facilities, improved electrostatic dust precipitation in the synthetic ammonia production process, and built and put into operation a biological treatment tower. After treatment, the cyanogen content in wastewater was reduced from 9 mg per liter to under 0.5 mg per liter, which is lower than the emission standards prescribed by the state. The water can be used a second time and saves 1,440 tons of fresh water per day. The plant has also transformed its urea, ammonia and other production systems so that the ammonia content in all wastewater is 90 percent lower than in the past. The plant is conscientiously summing up its experience and is determined further to improve its environmental protection work.

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YUNNAN POWER PLANT CONTROLS POLLUTION

Kunming YUNNAN RIBAO in Chinese 27 Dec 83 p 2

[Article by Chen Dezhi [7115 1795 1807]: "The Kaiyuan Power Plant Controls the 'Three Wastes,' Beautifies the Environment, Institutes Comprehensive Utilization and Transforms Waste Into Treasure"]

[Text] With the support, supervisionand encouragement of environmental protection departments, the Kaiyuan Power Plant has achieved considerable economic results in the control of environmental pollution, comprehensive utilization, converting wastes into treasure and the beautification of the environment.

Located within the city limits of Kaiyuan on the bank of the Lu River, the plant previously caused great resentment among the masses by its "three wastes" and serious pollution. In 1979, environmental protection departments demanded that the plant control its industrial pollution within a certain time limit. The plant party committee gave this matter serious attention and stipulated the following control measures: "Ashes shall not be flushed into the Lu River, cinders shall be collected in piles, soot comprehensively utilized and smoke and dust emissions limited." After more than 2 years of work, the plant completed the first stage of its construction project, a cement factory with a capacity of 200 tons per day. Up to now, this factory has produced 46,000 tons of cement, valued at 1.15 million yuan. The plant also shipped 42,000 tons of soot to the Kaiyuan Cement Co, which earned an additional income of over 1 million yuan for the cement factory. Utilizing cinders to manufacture bricks prompted the establishment of an enterprise which now produces 5,000 cinderblocks a day and earns an additional income of over 10,000 yuan a year. The plant also adopted a two-stage method of recycling ash-flushing water, thereby saving 2.6 million tons of water, 300,000 kWh of electricity and 25,500 yuan in costs every year. By means of split-flow purification, the plant recovered coal dust, which was then returned to fire boilers and thereby annually saved 844 yuan in fuel costs. The plant also installed ash separators, which reduced dust emissions and alleviated air pollution. While actively implementing control measures, the plant every year has mobilized its staff and workers to plant trees and beautify the environment, and the plant's forested area has increased from 18,600 to 28,600 square meters.

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